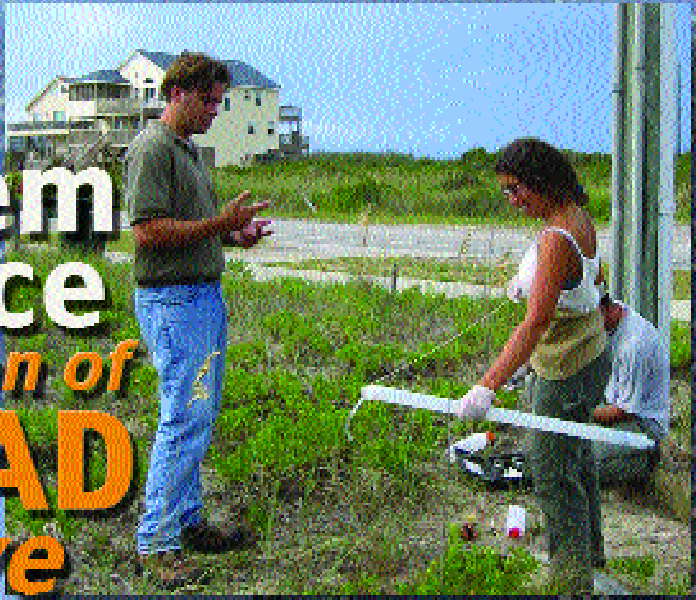
SMALL FLOWS QUARTERLY

SF

Helping America's Small Communities Meet Their Wastewater Needs

JURIED ARTICLE

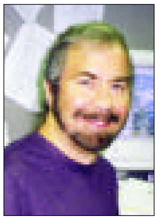
Performance Evaluation of a Recirculating Sand Filter and Peat Filter in West Virginia



Septic System Maintenance *Helps Keep Vision of* NAGS HEAD *Alive*

NATIONAL SMALL FLOWS CLEARINGHOUSE

Winter 2003 Volume 4 Number 1


Timothy Suhrer,
Editor

When federal regulations threaten to shut down a community's wastewater treatment facility for being out of compliance, residents who have to foot the bill for upgrades are often shocked at the cost. The price of clean water can be quite high, but so is the cost of contaminated drinking water. Waterborne diseases kill millions of people worldwide each year.

According to the U.S. Environmental Protection Agency, over half of the U.S. population (53 percent) receives its drinking water from groundwater sources, including private wells. Well water pollutants come from a variety of sources, and while there are no definite statistics linking onsite wastewater treatment systems to well water contamination, failed septic systems have been linked to several disease outbreaks in the U.S.

At the NSFC, we believe that proper design and management can prevent onsite system failure and that the problem of drinking water pollution needs to be addressed at both ends. So, for those readers who think that the rancid pools spreading out over their drainfields affect only them, and for readers with wells they want to keep safe, we offer an article (pg. 13) devoted to the technology, installation, and testing of private drinking wells.

Welcome to our fourth winter issue of the *Quarterly*, where we offer a look at onsite management on the beaches of Nags Head, North Carolina (pg. 18), self-reliance in Texas (pg. 20), and a new way Ohio has found to finance onsite projects (pg. 22). Please feel free to send us your comments and suggestions for articles you would like to see in future issues.

Timothy Suhrer

CALL for papers

Small Flows Quarterly

Papers are now being accepted for the juried article section of the *Small Flows Quarterly*, the only magazine/journal devoted to onsite and small community wastewater issues (i.e., communities with populations less than 10,000 or communities handling fewer than one million gallons of wastewater flows per day).

For additional information about the *Small Flows Quarterly*, manuscript submission guidelines, and publication deadlines, please contact Cathleen Falvey at **cfalvey@wvu.edu**, or phone 800-624-8301, ext. 5526, or write to Editor, *Small Flows Quarterly*, National Small Flows Clearinghouse, West Virginia University, P.O. Box 6064, Morgantown, WV 26506-6064.

Helping America's Small Communities Meet Their Wastewater Needs

Small Flows Quarterly is sponsored by:

U.S. Environmental Protection Agency
Steve Hogye | Project Officer
Municipal Support Division, Office of Wastewater Management, Washington, D.C.

National Small Flows Clearinghouse at West Virginia University
John L. Mori, Ph.D. | Manager
WVU National Environmental Services Center

Peter Casey, P. Eng. | Program Coordinator
Timothy Suhrer | Editor
Cathleen Falvey | Associate Editor
John Fekete | Senior Graphic Designer
Laurel Guthrie and Sukhjeet Sahni | Promotions
Natalie Eddy | Staff Writer
Nikki Stiles | Staff Writer
Jennifer Hause | Engineering Scientist
Andrew Lake | Engineering Scientist
David Pask, P.Eng. | Engineering Scientist
Ed Winant, Ph.D. | Engineering Scientist

Article Submissions
Small Flows Quarterly welcomes letters to the editor, articles, news items, photographs, or other materials for publication. Please address correspondence to:

Editor, *Small Flows Quarterly*
National Small Flows Clearinghouse
West Virginia University
P.O. Box 6064
Morgantown, WV 26506-6064
(800) 624-8301 or (304) 293-4191
http://www.nsfc.wvu.edu

The National Small Flows Clearinghouse, established by the U.S. Environmental Protection Agency (EPA) under the federal Clean Water Act (CWA) in 1977 and located at West Virginia University, gathers and distributes information about small community wastewater systems. *Small Flows Quarterly* is funded through a grant from the EPA.

International Standard Serial Number: 1528-6827

SF

IN THIS ISSUE...

NATIONAL SMALL FLOWS CLEARINGHOUSE

On the cover: Nags Head, North Carolina. The town has launched an innovative program to maintain local septic systems and educate visitors about onsite system operation and maintenance. Photos by Todd Krafft.

NOWRA To Develop Model Performance Code for Onsite Systems

The National Onsite Wastewater Recycling Association (NOWRA) is developing a model onsite wastewater system performance code with the assistance of volunteers and financial help from the U.S. Environmental Protection Agency (EPA) and onsite system manufacturers.

NOWRA's objective is to produce a model onsite wastewater system performance code document that represents a national consensus and that is developed by a broad base of onsite industry experts for adoption by local and state governments. If local and state governments adopt NOWRA's model code, onsite wastewater treatment technologies will be regulated consistently across political boundaries, replacing the current patchwork of unique, locally written codes that many see as inhibiting the diffusion of treatment technologies.

The NOWRA Board authorized the project in 2000 and appointed Mike Corry, Safety and Buildings Division administrator for the State of Wisconsin, as overall committee chair and Jean Caudill, State of Ohio Department of Health, as vice chair. The committee held its first meeting in May 2001 in Madison, Wisconsin, and held subsequent meetings in Athens, Georgia; Newport, Rhode Island; Seattle, Washington; Kansas City, Missouri; and Nashville, Tennessee. Another meeting is scheduled for Arizona in February or March 2003.

The committee has held meetings around the country to encourage local participation and to build a national consensus. Approximately forty people have attended at least one meeting, with a consistent participation of approximately 28 individuals from 20 states.

If local and state governments adopt NOWRA's model code, onsite wastewater treatment technologies will be regulated consistently across political boundaries, replacing the current patchwork of unique, locally written codes that many see as inhibiting the diffusion of treatment technologies.

The model code is designed to promote local decisions concerning treatment performance. Once performance standards are selected locally, the technologies listed by NOWRA as meeting those performance requirements should then be available in that jurisdiction.

"The NOWRA code development process is somewhat unique among model codes, because it is a performance code, not prescriptive, and is developed in an informed choice style," said Corry. "Most model codes are dominated by prescriptive solutions to undefined problems."

A performance code defines the problem and sets performance standards to resolve it. The designer selects a solution and the regulator verifies it. NOWRA's proposed evaluation protocol is designed to give the regulator that assurance.

"This model will present local and state onsite code writers with a range of treatment system options that can be matched with a desired range for output performance standards," said Corry. "It will also use this data to recommend quality assurance methodologies. The choice model is used because the risk of potential adverse effects of onsite systems on the human and natural environments varies from place to place, and, therefore, the standards applied should match the risk." NOWRA is promoting this method as being better than the one-size-fits-all approach of many other model codes.

The committee has developed a method for classifying an onsite wastewater treatment system according to the final level of treatment that can be expected for fecal coliform, total nitrogen, nitrate, total phosphorus, five-day biochemical oxygen demand, total suspended solids, and pH. It also is working to develop a protocol for submitting systems for evaluation and plans to produce guidance documents to assist local and state governments in choosing which performance classifications to adopt as performance standards for their various environments.

The completion date of the model code depends upon the amount of resources that the volunteer committees can devote to the project. Corry plans to leave state service and work full-time on the code development beginning in January 2003. "This should speed up the project because I will be able to assist the volunteer committees in their work," he said.

For information about NOWRA, visit the organization's Web site at **www.nowra.org**, or call (410) 798-1697 or (800) 966-2942.

EPA Will Help Local Governments Meet Environmental Goals

The U.S. Environmental Protection Agency (EPA) Office of Water has announced that eight organizations from across the nation will serve as Environmental Management Systems (EMS) Local Resource Centers, where local governments can go to make their operations more environmentally friendly.

"What this means is local communities can treat their wastewater more effectively and efficiently and reduce costs to taxpayers," said G.Tracy Mehan, assistant administrator for water. "EMS is a powerful management tool that in the end helps local citizens enjoy a cleaner, healthier environment."

For more information, visit **www.peercenter.net/resourcecenters/** or contact Nick Martin at (703) 750-6401 or **nmartin@getf.or g**.

Environmental Management Systems Local Resource Centers

Purdue University
Indiana Clean Manufacturing
Technology and Safe Materials Institute
School of Civil Engineering
2655 Yeager Road
West Lafayette, Indiana 47906
Phone: (765) 463-4749
Contact: Dr. Lynn Corson
corson@perdue.edu
www.ecn.purdue.edu/CMTI

University of Wisconsin-Stout
EDA University Center
103 1st Avenue W
Menominee, Wisconsin 54751
Phone: (715) 232-5023
Contact: Joe Benkowski
benkowskij@uwstout.edu
www.uwstout.edu

University of Florida
Center for Training, Research, and Education for Environmental Occupations
3900 SW 63rd Boulevard
Gainesville, Florida 32608
Phone: (352) 392-9570
Contact: Dr. William Engel
bengel@treeo.doce.ufl.edu
www.treeo.ufl.edu

Georgia Institute of Technology
Center for International Standards and Quality
143 O'Keefe Building
Atlanta, Georgia 30332
Phone: (404) 894-0968
Contact: Holly Lawe
holly.lawe@edi.gatech.edu
www.industry.gatech.edu/quality/default.htm

University of Massachusetts at Lowell
Environmental Management Systems Service Center
One University Avenue
Lowell, Massachusetts 01854
Phone: (978) 934-4741
Contact: Matthew Donahue
matthew_donahue@uml.edu
www.uml.edu/ems

Texas Commission on Environmental Quality
Small Business and Environmental Assistance Division
12100 Park 35 Circle
Austin, Texas 78753
Phone: (512) 239-3145
Contact: Ken Zarker
kzarker@tnrcc.state.tx.us
www.abouttexasems.org

Virginia Tech University
Center for Organizational and Technological Advancement
110 Shenandoah Avenue
Roanoke, Virginia 24016
Phone: (540) 853-8276
Contact: Robert Herbert
bherbert@vt.edu
www.cota.vt.edu

The Zero Waste Alliance
One World Trade Center
121 SW Salmon Street, Suite 210
Portland, Oregon 97204
Phone: (503) 279-9383
Contact: Larry Chalfan
lchalfan@zerowaste.org
www.zerowaste.org

Calendar of Events

MARCH

16th Annual Septic Systems Conference
Granite State Designers and Installers Association
March 3
Manchester, New Hampshire
(603) 228-1231
www.gsdia.org

Water and Wastewater Europe
PennWell
March 4–6
Nice, France
Phone: +44 (0) 1992 656 631
www.pennwell.com/
koula@pennwell.com

Nevada Rural Water Association Training and Technical Conference
Nevada Rural Water Association
March 4–6
Carson City, Nevada
(755) 884-2055

The Great Lakes: Managing and Understanding a System Under Change
Institute of Water Research, Michigan State University
March 6
East Lansing, Michigan
(517) 353-3826
fluker@msu.edu

Wisconsin Spring 2003 Biosolids Symposium
University of Wisconsin, Madison
March 11
Stevens Point, Wisconsin
(606) 267-7611
kesterg@dnr.state.wi.us

Alabama Environmental Health Association Conference
AEHA, Inc.
March 18–19
Eufaula, Alabama
(205) 338-3357
TerryYoung@adph.state.us

Princeton Groundwater Presents: The Remediation Course
Princeton Groundwater
March 18–22
Denver, Colorado
(813) 964-0800
info@princeton-groundwater.com

5th Annual Onsite Wastewater State Regulators Conference
The National Small Flows Clearinghouse
March 24–27
Las Vegas, NV
(800) 624-8301—Sandy Miller
www.nsfc.wvu.edu

Seeds of Growth—Sustainable Community Development Conference
Federal Reserve System
March 27–28
Washington DC
www.federalreserve.gov/communityaffairs/national/CA_Conf_SusCommDev/default.htm

NAHB 5th Annual National Green Building Conference
National Association of Home Builders
March 30–April 1
Baltimore, Maryland
(800) 368-5242 ext. 8341
hhutchison@nahb.com

APRIL

Asset Management and CMOM Programs for Gravity Sewer Systems
University of Nevada, Las Vegas
Division of Educational Outreach
April 2–4
Las Vegas, Nevada
(702) 895-3394
edoutreach.univ.edu

Designing Wastewater Pumping Systems and Lift Stations
University of Wisconsin
Dept. of Engineering Professional Development
April 7–9
Madison, Wisconsin
(800) 462-0876
epdweb.engr.wisc.edu/brochures/E852.html

MAY

Asset Management and CMOM Programs for Pump Stations
University of Nevada, Las Vegas
Division of Educational Outreach
May 7–9
Las Vegas, Nevada
(702) 895-3394
edoutreach.univ.edu

AWRA Specialty Conference
Amercian Water Resources Association
May 12–14
Kansas City, Missouri
(800) 368-5242 ext. 8341
www.awra.org

JUNE

WEF/WEAT Collection Systems 2003 Conference: Current Trends in Collection System Management
Water Environment Federation/ Water Environment Association of Texas
June 2–5
Austin, Texas
(303) 756-9090, ext. 306
kbrandow@neha.org

NETA 25th Annual Conference and Workshops
National Environmental Training Association (NETA)
June 6–10
Reno, Nevada
(602) 956-6099—Charles Richardson
rick@ehs-training.org

NEHA 2003 67th Annual AEC and Exhibition
National Environmental Health Association
June 8–9
Reno/Lake Tahoe, Nevada
(303) 756-9090, ext. 306
kbrandow@neha.org

4th National Workshop on Constructed Wetlands/BMPs for Nutrient Reduction and Coastal Water Protection
Water Resources Research Institute of the University of North Carolina
June 23–25
Wilmington, North Carolina
www.cals.ncsu.edu/waste_mgt/workshop.htm

JULY

11th Annual National Association of Local Boards of Health (NALBH) Conference
NALBH
July 16–19
Baltimore, Maryland
(419) 353-7714
www.nalboh.org

2003 Annual Soil and Water Conservation Society Conference
Soil and Water Conservation Society
July 26–30
Spokane, Washington
(515) 289-2331
www.swcs.org/
memberservices@swcs.org

SEPTEMBER

12th Northwest On-Site Wastewater Treatment Short Course and Equipment Exhibition
University of Washington
September 22–23
Seattle, Washington
(866) 791-1275
www.engr.washington.edu/~uw-epp/Wwt/

If your organization is sponsoring an event that you would like us to promote in this calendar, please send information to the *Small Flows Quarterly*, Attn. Tim Suhrer, National Small Flows Clearinghouse, West Virginia University, P.O. Box 6064, Morgantown, WV 26506-6064. Or you may contact Suhrer at (800) 624-8301 or (304) 293-4191, ext. 5587, or via e-mail at **tsuhrer@wvu.edu**.

Wastewater on the web...

American Society of Agricultural Engineers (ASAE)

www.asae.org/

The ASAE is a professional and technical organization dedicated to the advancement of engineering applicable to agricultural, food, and biological systems. ASAE members have access to emerging technologies, standards, academic programs, career resources, and employment opportunities. To become an ASAE member, you can fill out an application and pay yearly dues online.

American Water Resources Association (AWRA)

www.awra.org/

AWRA's mission is to advance multidisciplinary water resources management and research. Their Web site includes information about AWRA history, conferences, events, and careers. Users can also order copies of AWRA publications such as, the *Journal of the American Water Resources Association* (JAWRA), which contains 120 scientific papers and over 1,300 pages and *Water Resources IMPACT*, which focuses on practical solutions to water resource problems.

Alabama Onsite Wastewater Training Center (AOWTC)

www.uma.edu/aowtc/

The AOWTC is dedicated to expanding public awareness of water quality issues, with a particular emphasis on wastewater management. Their mission is to install and demonstrate various advanced wastewater treatment systems, to provide information regarding installation, cost, maintenance, and suitability of site conditions. AOWTC's goal is to change the attitude and behavior of local and state policy makers and the general public by educating them on the use of advanced treatment systems and to serve as a regional and international demonstration and educational facility. The site features a list and description of training courses available at AOWTC and a registration form for the advanced installers licensing class.

Border EcoWeb

www.borderecoweb.sdsu.edu/main.htm

The Border EcoWeb is designed to facilitate public access to environmental information for the U.S./Mexican border region. This project was created to develop an arena where community members can find out what other people and groups are doing to resolve border environmental problems. The site strives to achieve this through inventory and directory components. The Border EcoWeb Inventory provides brief descriptions and links to various datasets available on the Internet. The directory contains contact information and project descriptions for agencies and groups involved in activities dealing with the border environment.

Environment, Safety and Health (ES&H) Information Portal

www.tis.eh.doe.gov/portal/home.htm

The ES&H Information Portal, sponsored by the U.S. Department of Energy's (DOE) Office of Environment, Safety and Health (ES&H), is dedicated to making current information available to environment, safety, and health professionals, but the site also provides valuable information for other readers as well. The main page contains the latest about ES&H news and conferences. By clicking on DOE and the Community, users learn how the DOE works to address community and stakeholder issues and concerns in the areas of environment, health, and safety.

National Environmental Publications Information System (NEPIS)

www.epa.gov/clariton/

On U.S. Environmental Protection Agency's (EPA) NEPIS site, users can order hard copies of documents and print and view some EPA documents online. By conducting a simple search, documents can be viewed as page images. By doing an enhanced search, documents can be viewed as page images, but they can also be viewed as text files, which can be searched further. Another option is to conduct an EPA site search, which searches all Web pages and portable document image files (PDF) located on the EPA Public Access Server.

WWW Virtual Library-Environment

www.earthsystems.org/virtuallibrary/index.html

The WWW Virtual Library-Environment, part of the larger WWW Virtual Library project, is an index of useful and informative Web sites about environmental topics. The WWW Virtual Library-Environment is maintained by earthsystems.org, a nonprofit environmental education organization. It is a searchable index of more than 1,000 carefully screened links arranged alphabetically and by category.

Guide Highlights Local Governments' Efforts To Protect Streams

The Institute for Environmental Negotiation at the University of Virginia recently produced a guide, *A Stream Corridor Protection Strategy for Local Governments*, to help local government staff and others formulate a protection strategy for their stream(s), in order to protect the health of their communities. The guide serves as a primer for project planning and the development of new tools to protect and restore stream corridors.

While targeted to communities within the Chesapeake Bay watershed, the guide is relevant to all local government planners, engineers, planning commissioners, boards of supervisors and city and town councilors.

The guide is divided into the following chapters:

1. "The Benefits of Local Stream Protection,"
2. "Assessing a Stream's Current Condition and Future Impacts Upon It,"
3. "Deciding on a Protection Strategy,"
4. "Tools for a Stream Protection Strategy,"
5. "Creating and Managing Buffers,"
6. "Monitoring and Maintenance," and
7. "Case Studies."

Copies of the guide may be ordered by calling (434) 924-1970. To download a PDF version of the guide, go to the Institute's Web page at **www.virginia.edu/~envneg/stream%20guide_final.pdf%202**.

Best Management Practices for Source Water Protection Subject of New Fact Sheets

The U.S. Environmental Protection Agency (EPA) has published a series of fact sheets about best management practice (BMP) measures for activities likely to impact drinking water sources. Each bulletin discusses how particular activities can be managed in such a way as to prevent drinking water contamination.

Available bulletins include:

- highway de-icing,
- stormwater runoff,
- septic systems,
- above and underground storage tanks,
- vehicle washing,
- managing small-quantity chemical use,
- small- and large-scale application of pesticides,
- agricultural fertilizer, and
- sanitary sewer overflows and combined sewer overflows.

These fact sheets complement EPA's source water protection training course. The training course is available through the EPA Drinking Water Academy.

If you are interested in sponsoring a training course, please contact James Bourne at (202) 260-5557 or Steve Ainsworth at (202) 260-7769. To access the bulletins online in PDF format, visit **www.epa.gov/ogwdw/protect/swpbull.html.**


EPA Source Water Protection Practices Bulletin
Managing Sanitary Sewer Overflows and Combined Sewer Overflows to Prevent Contamination of Drinking Water

EPA Source Water Protection Practices Bulletin
Managing Storm Water Runoff to Prevent Contamination of Drinking Water

EPA Source Water Protection Practices Bulletin
Managing Septic Systems to Prevent Contamination of Drinking Water

Strategic Plan to Guide EPA's Homeland Security Efforts

On October 2, 2002, U.S. Environmental Protection Agency (EPA) Administrator Christine Whitman announced EPA's Strategic Plan for Homeland Security. The plan is intended to support the President's National Strategy for Homeland Security and the efforts undertaken by a new Department of Homeland Security.

Using its core mission of protecting public health and safeguarding the environment, the EPA's senior leadership has closely examined the organization's role in protecting against and responding to any future terrorist attacks.

The plan identifies goals in four mission-critical areas:

- critical infrastructure protection;
- preparedness, response, and recovery;
- communication and information; and
- protection of EPA personnel and infrastructure.

The strategic plan lays out goals, tactics, and results in each of these areas. The plan will serve as a blueprint for the agency's senior leadership about how to enhance EPA's ability to meet its homeland security responsibilities.

Specifically, EPA plans to work with states and local drinking water and wastewater utilities on security enhancement and "to ensure that critical environmental threat monitoring information and technologies are available to . . . local governments [and others] to assist in threat detection."

To view the Agency's strategic plan in PDF format, visit **www.lgean.org/documents/homeland_security.pdf**.

New Guide Addresses Protecting Sensitive Water Security Information

The Association of Metropolitan Water Agencies (AMWA) has published a guide called *State Freedom of Information Act (FOIA) Laws: A Guide to Protecting Sensitive Water Security Information.*

In light of utilities' recent actions to secure their systems by conducting vulnerability and risk assessments, preparing emergency responses to terrorism, and complying with government mandates, AMWA prepared this guide to assist utilities assess the relevance of their state FOIA laws to their particular situations. The document also outlines possible strategies for amending state statutes (if appropriate) and provides legislative language targeting state disclosure exemptions.

The guide is divided into five parts:

- general themes associated with State FOIA issues,
- state FOIA models that utilities can use to lobby their governors and state legislators,
- strategies for gaining legislative and political approval,
- FOIA-related amendments recently passed by the states of Virginia and Iowa that have already strengthened their laws to protect sensitive information; and
- categorization of the FOIA laws and policies of the 50 states and the District of Columbia.

The guide can be found at **www.amwa.net/isac/StateFOIA.pdf**.

New Report Examines the Integration of EMSs at Water and Wastewater Utilities

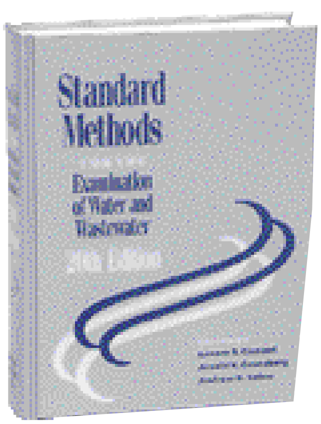
The Water Environment Federation (WEF), the Association of Metropolitan Sewerage Agencies (AMSA), and the U.S. Environmental Protection Agency (EPA) have recently released the *EMS Integration Project Workgroup Report*. The report develops a series of recommendations about how water and wastewater utilities can improve management practices and outcomes in environmental, financial, and other aspects of utility operation.

The goal of this project was to help develop a “roadmap” that would assist utility managers understand the different programs, tools, and systems; how these elements might interrelate; how they might be used to meet utility objectives; and how they might effectively nest within the framework of a continual improvement management system, such as an environmental management system (EMS). The workgroup believes that, because drinking water and wastewater utility operations primarily focus on environmental and public health impacts, EMSs are a natural starting point for introducing a continual improvement management system into a utility.

These management system frameworks provide a well-established and proven continual improvement management approach, based on the conceptually simple “plan, do, check, act” process. Benefits associated with the management system frameworks, as indicated by the interviews with utility managers, include:

- continual improvement in environmental, financial, and other management outcomes;
- greater operational consistency and reliability;
- improved teamwork and interdepartmental coordination; and
- critical customer responsiveness.

To view the workgroup’s findings online, visit **www.wef.org/pdffiles/EMSfinalreport.pdf** .



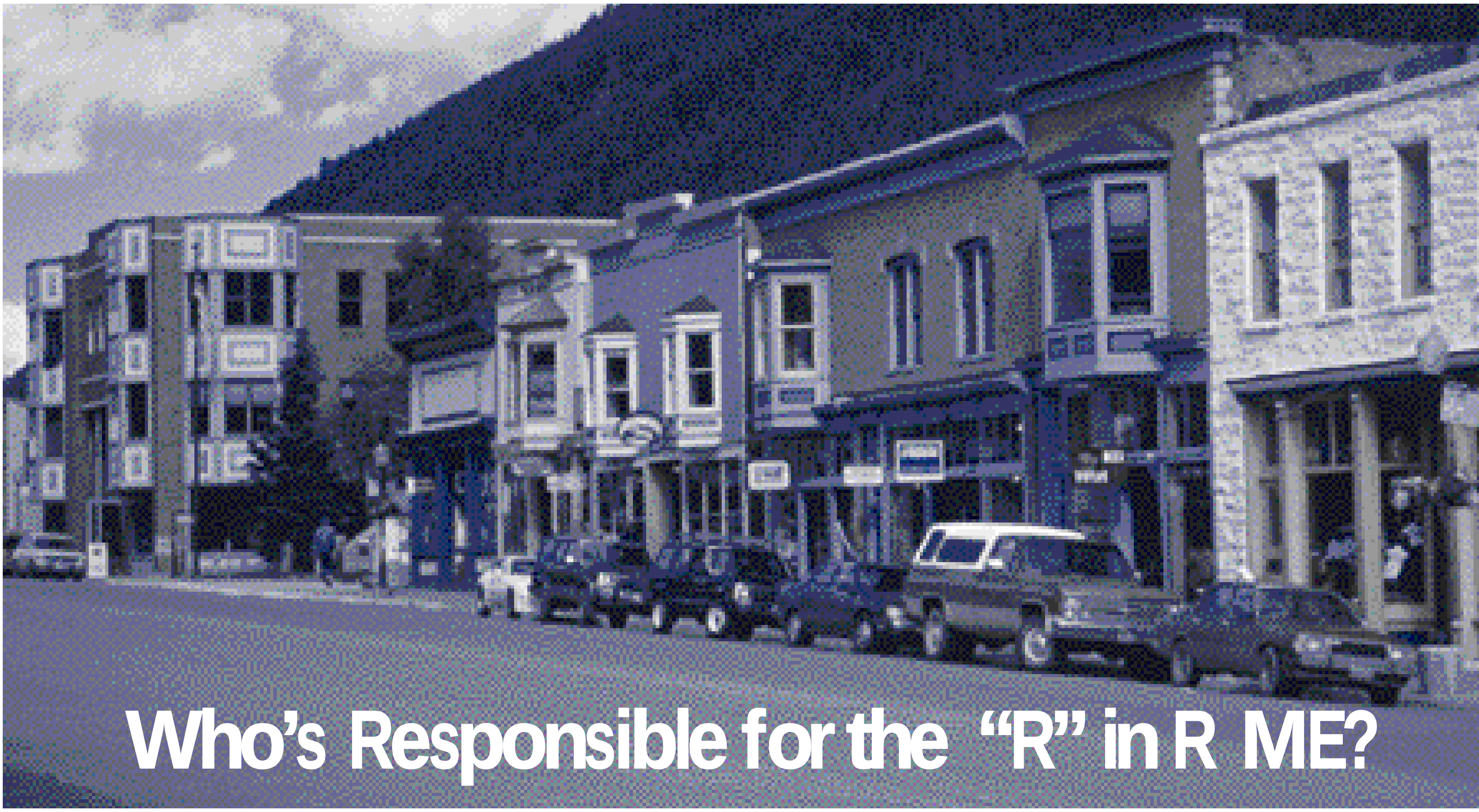
EPA Approves Latest Edition of *Standard Methods*

A coalition of water and wastewater organizations has announced the U.S. Environmental Protection Agency’s (EPA) approval of the 20th Edition of *Standard Methods for the Examination of Water and Wastewater* Serving as a comprehensive guide for testing water and wastewater, this latest edition was created through a joint effort of the Water Environment Federation (WEF), the American Water Works Association (AWWA), nd the American Public Health Association (APHA). The EPA ruling on the approval will be published in the *Federal Register*.

Since 1905, *Standard Methods for the Examination of Water and Wastewater* has served as the industry guide for water quality testing of a wide variety of contaminants, including arsenic, biochemical oxygen demand, and organic compounds. The guide provides more than 350 separate methods of water quality measurements used by water and wastewater industry scientists, analysts, and engineers nationwide.

“EPA approval of the latest edition of this important water quality resource underlines its importance and credibility to industry experts,” said Jack Hoffbuhr, executive director of AWWA. “The guide provides the most comprehensive collection of water analysis techniques in the world, and will undoubtedly go a long way in helping utilities provide a higher level of service to consumers with the interest of the public health the utmost priority.”

Standard Methods for the Examination of Water and Wastewater can be ordered online from the AWWA, APHA, and WEF bookstores at **www.awwa.org**, **www.apha.org/media**, or **www.wef.org**; or via telephone at (800) 926-7337 (AWWA), (301) 893-1894 (APHA), or (800) 666-0206 (WEF).



Who's Responsible for the "R" in RME?

NSFC CONTRIBUTING WRITER

Jean Caudill, R.S.

The National Onsite Wastewater Recycling Association (NOWRA) held a national roundtable forum on the topic of responsible management entities (RME) at its 2002 conference held in Kansas City in September. I was asked to participate on the panel and to represent the "regulator perspective." It is always risky to try to represent a group of onsite professionals when there are many diverse views. I did make an effort to gather input from the onsite regulatory community, though no blame should be assigned to anyone other than me for the perspectives I presented at the roundtable discussion or will present in this forum piece.

I would like to recognize those who responded to my request for input. From an inquiry I posted on the NSFC State Regulators' Listserve, I received responses from Doug Ebelherr of Illinois, Jay Prager of Maryland, Ed Corriveau and John Borland of Pennsylvania, Allan Knapp of Virginia, and Terry Hull of Washington State. In August, there was also a mass (or mess) of RME discussions on the U.S. Environmental Protection Agency's Decentralized Wastewater Treatment Listserve, to which Mike Corry of Wisconsin gave a regulator's perspective. And finally, I need to thank those in Ohio, my cohorts at the Ohio Department of Health (ODH), my old buddies from the Clermont County General Health District, and the representatives from 42 local health departments in Ohio who responded to an ODH survey on operation inspection programs in their jurisdictions.

I think it is also important to give credit for the development of the term "RME." If I am not mistaken, the credit for "engineering" this term goes to Chris English of the U.S. Department of Agriculture in Minnesota and Tom Yeager of Kennedy/Jenks Consultants in California. (See their juried article in the *Spring 2002 SFQ*, "Responsible Management Entities as a Method To Ensure Decentralized Wastewater System Viability.") The use of this term has now been institutionalized in the USEPA *Guidelines for Management of Onsite/Decentralized Wastewater Systems* and the 2002 USEPA *Onsite Wastewater Treatment System Manual*.

In this forum piece, I would like to expound on the first and third letters of the RME term, starting with a brief discussion of the letter "E." I am not going to address the central "M", as I am assuming that most onsite professionals have come to accept the critical need for management in the industry. I will more fully discuss the "R," giving my perspective on the question posed in the title: "Who's responsible for the "R" in RME?" Finally, I will address what I believe to be the regulator's responsibility in this effort to assure effective management of our onsite wastewater infrastructure.

The "E" in RME might also mean responsible management by everyone, with the regulator's job to be holding everyone accountable for the role they have in the process. It is also everyone's responsibility to promote statutes and rules that provide regulators with the oversight and enforcement mechanisms to assure accountability. Webster's definition of *regulate* is to direct according to rule. Regulators are not totally responsible for making these rules. In our democracy, everyone gets to participate.

The "R" in RME is deservedly first, because acceptance of responsibility is the key to successful acceptance of the need for management of our onsite

> "My nightmare is to wake up five years from now and find that we have sold and installed 10 million advanced treatment systems that are failing because of . . . lack of management."
>
> Christopher English

wastewater infrastructure. Until responsibility is assigned, accepted, and acted upon by all the players involved in the comprehensive management of onsite systems, we will have limited success in our efforts to build sustainable onsite wastewater infrastructure. I will quote Chris English in expressing my worst fear: "My nightmare is to wake up five years from now and find that we have sold and installed 10 million advanced treatment systems that are failing because of . . . lack of management."

I am sometimes concerned that we are attracted to the RME concept because we think that "R" only applies to the "E." We are hopeful that the responsibility commonly not exercised by the homeowner will now suddenly be fully exercised by the entity. I would suggest that this is a false and fatal hope.

Effective management will require some level of responsibility by everyone involved, not just an entity. An RME does not relieve everyone else of their responsibilities. An RME cannot stand alone. The regulatory structure and the regulators' and others' responsibilities assigned within that structure will be critical to the success of the RME approach and all other approaches to management of our onsite wastewater infrastructure.

Given appropriate regulatory authority, hopefully with some flexibility and room for creativity built in, it is the regulator's job to provide a level of oversight that assures responsible management and appropriate and effective enforcement for poor or nonperformance. To achieve this, regulations must clearly define the roles of all parties, including the competencies and qualifications of RME personnel. The RME monitoring and reporting capabilities and requirements must be defined. Assurances related to long-term sustainability and responsiveness to both community and customer issues also must be addressed.

What I hope regulations and regulators do not do is box us in to one or two RME models and limit the application of multiple approaches to onsite wastewater management structures. I personally believe that there is no "best" model, but that any RME solution to onsite management is based on the community need—which in many cases may be no need for an RME. I believe the regulator does have a role in helping communities to assess this need.

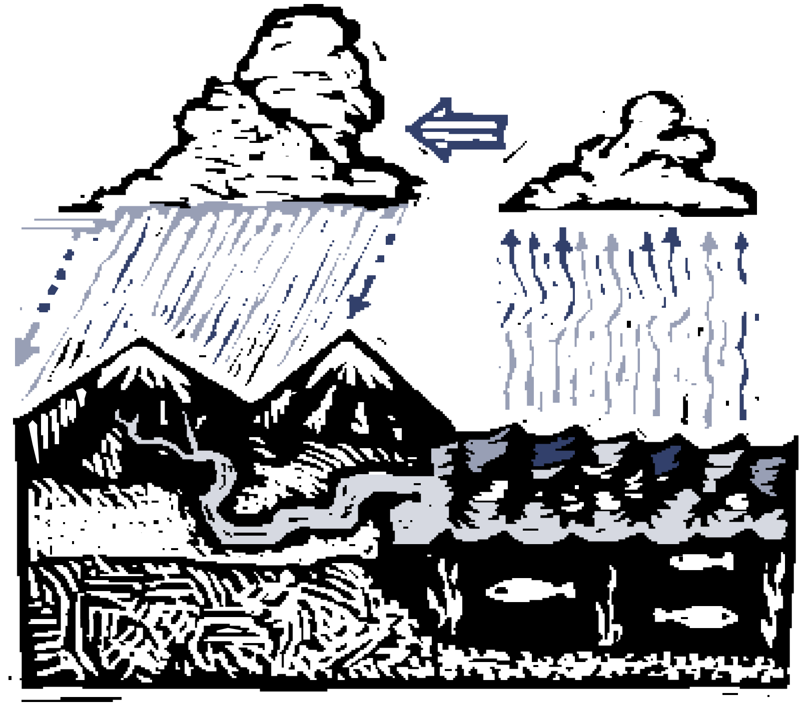
Quite often regulations and regulators are blamed for the lack of progress in the development of effective management approaches. If we as regulators are fully engaged with our communities and require accountability for proper management of onsite systems, we may no longer be so strongly perceived as a barrier to the process. Responsible regulators, as well as responsible onsite professionals across the industry, are a necessity if we are to build and manage a sustainable decentralized onsite wastewater infrastructure.

Jean Caudill, R.S., is a program specialist with the Ohio Department of Health. She was formerly the director of water and waste at the Clermont County General Health District in Batavia, Ohio.

Like what you are reading?

Want to reprint an article in your publication?

The National Small Flows Clearinghouse (NSFC) encourages readers to reprint *Small Flows Quarterly (SFQ)* articles in local newspapers, newsletters, Web sites, educational presentations, flyers, or any other publications. Please include the name and phone number of the NSFC and send us a copy of the reprinted information for our files. All articles from the *SFQ* are available for download from our Web site. If you have any questions about reprinting articles or about any of the topics discussed in this magazine, please feel free to contact the NSFC at (800) 624-8301 or check out our Web site at **www.nsfc.wvu.edu**.



Just as above the earth, small drops form and these join others, till finally water descends in a body as rain, so too we must suppose that in the earth the water at first trickles together little by little and that the sources of rivers drip, as it were, out of the earth, and then unite.

—Meteorologica, Aristotle (384–322 B.C.)

How To Keep Your Water "Well"

NSFC STAFF WRITER
Natalie Eddy

Since the beginning of human history, the search for water has guided the formation of kingdoms. History tells us its presence both sparked development and spurred devastation.

People searched for water, fought for water, and even died for it. It is nourishment—without it, life cannot exist. Yet today, most of us take it for granted—the clear, thirst-quenching liquid that flows effortlessly from our kitchen and bathroom fixtures. We turn the faucet on, and there seems to be no end to this precious resource.

With such convenience, it is not surprising that the U.S. uses more water than any other country. The average individual uses 40 to 50 gallons of drinking water per day. Although it is labeled "drinking water," only a small portion is actually used for drinking. The majority is used for other purposes, such as toilet flushing, bathing, cooking, cleaning, and lawn watering.

The quality of our water reflects our general quality of life as a society. Whether we retrieve our water from a public treatment system or private well, all of the water we use comes from either surface water or groundwater.

Surface water sources include rivers, lakes, and reservoirs while most groundwater comes from rain and melting snow, which soaks through the ground getting trapped in spaces between rocks and soils. These underground water formations, called aquifers, may be only a few miles wide or may encompass the areas of many states.

The majority of private drinking water supplies draw groundwater from wells, but some households obtain water from streams and cisterns (rain water collected from rooftops). In addition to individual home wells, there are also community wells that serve entire towns.

Large-scale water supply systems, found mostly in populated areas, are likely to rely on surface water sources, while small water systems, found in rural populations, tend to use groundwater as their source.

According to the U.S. Environmental Protection Agency (EPA), more than half of the U.S. population (53 percent or 151 million people) receives its drinking water from groundwater sources with approximately 8 percent or 23 million Americans retrieving their drinking water from private wells. Keeping wells free from contaminants requires careful planning, especially when an onsite system is in use nearby.

According to 1990 Census data, nearly one out of every four homes in the U.S. relies on some form of onsite system to treat and dispose of their household wastewater.

Because septic tank effluent contains bacteria, viruses, and high levels of nitrates from human waste, contamination is a major concern in the incidences of waterborne pathogens in private wells in the U.S.

It is estimated that septic tanks may have contaminated one to two percent of the nation's usable aquifers. With 800 billion gallons of water per year being discharged to the subsurface in the U.S. via septic systems, contamination of wells is an important problem to address.

Groundwater Quality

By nature, all water contains some impurities. Contrary to what you may read on bottled water labels, there is no such thing as naturally pure water.

As water flows through rivers and streams and filters through soil and rock, it absorbs many of the substances it touches. The water quality in an aquifer depends on the nature of the rock, sand, or soil in the aquifer and what contaminants are in the area.

The dissolved minerals and gases and the amount of suspended matter determines water quality. Some contaminants are harmless, but some compounds may make the water unpalatable and even unsafe.

One basic measurement of water quality is the total dissolved solids (TDS), a reflection of the total amount of solids remaining when a water sample is evaporated.

Water is made up of major constituents, such as chloride, sulfate, carbonate, and bicarbonate, and minor constituents, like iron, manganese, fluoride, nitrate, strontium, and boron. In addition, trace elements, such as arsenic, lead, cadmium, and chromium may be present. The trace elements are extremely important in determining water quality.

Prior to 1974, each state had its own drinking water program, setting the standards that had to be met. Standards were minimal at best. Since 1974, when Congress passed the original Safe Drinking Water Act, EPA has set uniform nationwide minimum standards for drinking water.

A process called risk assessment is used to set quality standards. EPA has issued more than 80 maximum contaminant levels (MCLs) for safe drinking water standards.

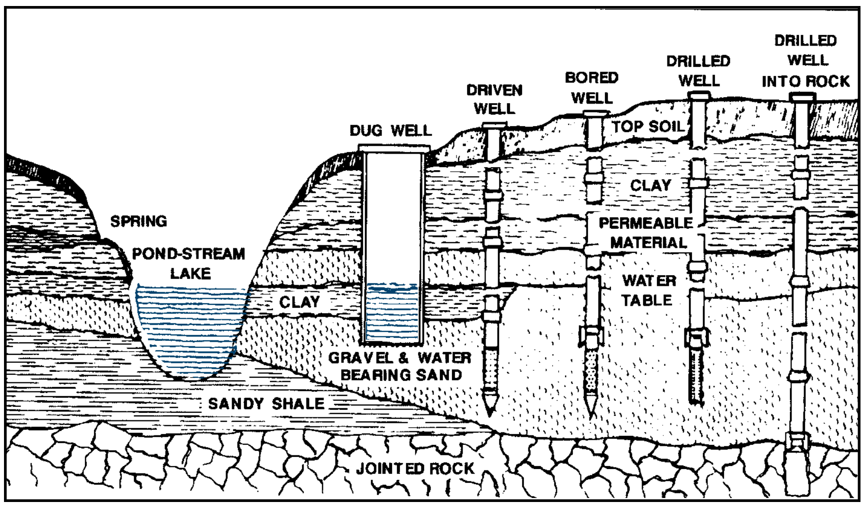
A Deep Subject

Private wells are not a new technology. People have been digging wells for centuries—long before modern technology was there to help. Primitive people would simply hand dig a hole deep enough to reach the water table. When the water filled the bottom of the hole, they would lower a bucket on a rope down to haul the water out.

Dug wells, which rarely exist today, are prohibited by many states because they are very susceptible to contamination from surface runoff.

Today most well drilling companies use large, truck-mounted rotary drills or auger bits. Wells may range up to 1,000 feet deep. There are three common types of wells—bored, driven, and drilled.

Bored wells are constructed with an auger. After the water table is reached, the hole typically is lined with steel pipe. The lower part of the well is provided with a screen to keep sand and other material from entering the water. Like dug wells, bored wells are subject to contamination unless the casing is sealed with grout and the well is at least 15 feet below ground surface.



Typical cross-section of underground strata, showing various types of well construction Reprinted with permission from the *Water Systems Handbook* described on page 17.

Driven wells are made with a series of pipes fitted with a well point on the end. The well point is forced through the ground by a series of blows on the pipe or by using water pressure, especially in sandy soils. When the point reaches the water table, water flows into the pipe through screened openings on the well point. Driven wells are useful when the water table is no deeper than 50 to 60 feet.

Drilled wells, the most common today, are used when the water table is at a greater depth, volume, or diameter or when the ground is too hard to use a well point. Drilled holes are lined with steel or plastic well casing.

Many experts recommend that the well casing extend to a depth greater than 25 feet or 10 feet below the static water level in sand and gravel formations.

Location, Location, Location

Placement of wells in relation to septic tank systems is an imperative factor in preventing contamination. Setback standards for wells and septic tank systems vary widely from state to state, most ranging from 50 to 100 feet. (Contact your local health department for your particular setback regulations.)

Those setback distances may increase should limiting factors exist, such as the presence of limestone, karst, or fractured bedrock in the soil formation.

Table 1 on Page 15 presents the minimum horizontal separations required by the state of Washington from their onsite regulations.

Design and operating standards are meant to ensure that a septic system does not malfunction. Most wastewater treatment experts recommend that a septic tank be pumped out every three to five years, depending on the size of the tank. Onsite owners also should inspect their system annually to make sure it is operating properly.

The minimum lot size per typical household septic system varies from 0.5 to 5 acres, depending on the state or municipality.

Still, contamination may occur when inadequately treated effluent rapidly infiltrates the unsaturated or vadose zone and reaches the water table.

The likelihood of septic tank contamination seems to be higher in areas where there is a high density of homes with septic tanks, the soil layer over permeable bedrock is thin or extremely permeable, and the water table is within a few feet of the land surface.

Having a well that is more than 10 years old or less than 50 feet deep increases the chance for contamination. In order for a septic system to function properly, it must be properly sited, designed, installed, and maintained.

Table 1 Minimum Horizontal Separations

Items Requiring Setback	*From edge of disposal component and reserve area*	*From septic tank, holding tank, containment vessel, pump chamber, and distribution box*	*From building sewer, collection, and non-perforated distribution line*[1]
Non-public well or suction line	100 ft.	50 ft.	50 ft.
Public drinking water well	100 ft.	100 ft.	100 ft.
Public drinking water spring, [3]	200 ft.	200 ft.	100 ft.
Spring or surface water used as drinking water source [2,3]	100 ft.	50 ft.	50 ft.
Pressurized water supply line [4]	10 ft.	10 ft.	10 ft.
Properly decommissioned well [5]	10 ft.	N/A	N/A
Surface water [3]			
Marine water	100 ft.	50 ft.	10 ft.
Fresh water	100 ft.	50 ft.	10 ft.
Building foundation	10 ft. [6]	5 ft. [6]	2 ft.
Property or easement line [6]	5 ft.	5 ft.	N/A
Interceptor/curtain drains/drainage ditches			
Down-gradient[7]	30 ft.	5 ft.	N/A
Up-gradient[7]	10 ft.	N/A	N/A
Down-gradient cuts or banks with at least 5 ft. of original, undisturbed soil above a restrictive layer due to a structural or textural change	25 ft.	N/A	N/A
Down-gradient cuts or banks with less than 5 ft. of original, undisturbed, soil above a restrictive layer due to a structural or textural change	50 ft.	N/A	N/A

[1] "Building sewer" as defined by the most current edition of the Uniform Plumbing Code. "Non-perforated distribution" includes pressure sewer transport lines.

[2] If surface water is used as a public drinking water supply, the designer shall locate the onsite sewage system outside of the required sanitary control area.

[3] Measured from the ordinary high-water mark.

[4] The local health officer may approve a sewer transport line within 10 feet of a water supply line if the sewer line is constructed in accordance with section 2.4 of the Department of Ecology's "Criteria For Sewage Works Design," revised October 1985, or equivalent.

[5] Before any component can be placed within 100 feet of a well, the designer shall submit a decommissioned water well report provided by a licensed well driller, which verifies that appropriate decommissioning procedures noted in chapter 173-160 WAC were followed. Once the well is properly decommissioned, it no longer provides a potential conduit to groundwater, but septic tanks, pump chambers, containment vessels or distribution boxes should not be placed directly over the site.

[6] The local health officer may allow a reduced horizontal separation to not less than two feet where the property line, easement line, or building foundation is up-gradient.

[7] The item is down-gradient when liquid will flow toward it upon encountering a water table or a restrictive layer. The item is up-gradient when liquid will flow away from it upon encountering a water table or restrictive layer.

Source: Collected from the NSFC State Onsite Wastewater Regulations Database

But even if the septic system is functioning properly and within proper setback limits, another factor to be considered is the placement of septic leachfields.

Since leachfields are generally located in areas where wastewater percolates through soil as part of the treatment process, placing leachfields close to a drinking water source can cause problems.

If your well tests positive for indicator organisms (e.g total coliforms or fecal coliforms), or chemical contaminants, but there are no septic systems nearby, public sewage treatment lines may be to blame. Leakage from sewer lines, which carry untreated raw sewage and may contain industrial waste, can introduce chlorides, microorganisms, organics, trace metals, and other chemicals.

Identification of Contaminants

In addition to failing or improperly sited septic tanks, a variety of human activities impact water quality. Pollution sources can range from industry, landfills, pesticides, fertilizers, livestock wastes, stormwater runoff from agricultural and urban sources, and household wastes.

The EPA recommends that private water wells be tested annually for indicator organisms and nitrate to detect contamination problems. Indicator organisms are not harmful in themselves, but their presence indicates that other pathogenic organisms, such as *E coli*, *Giardia lamblia*, *Cryptosporidium*, or hepatitis, could have survived.

The water also should be tested for other potentially dangerous contaminants, such as pesticides and radon.

In addition to the above annual tests, many water experts recommend a broad range of water tests should be done every 5 to 10 years.

Homeowners can access a list of certified laboratories from their state or local health department. Some health departments will conduct the tests for free. The average cost of a private laboratory test for nitrate and bacteria samples will typically range between $10 to $20.

Contamination Happens

According to the EPA, in 1993 and 1994 there were 30 reported disease outbreaks associated with drinking water, 23 associated with public drinking water supplies, and seven with private wells.

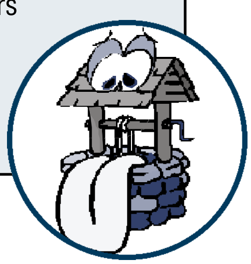
Although no definite statistics are available to document the potential contamination threat onsite systems may pose to drinking water, several cases of infectious disease outbreaks have been documented.

In Polk County, Arkansas, a 1971 outbreak of viral hepatitis was traced to a well that was contaminated by seepage from a septic tank located 95 feet away. In 1972, Yakima, Washington, experienced a typhoid outbreak that was attributed to well water from driven well points. Septic tank wastewater from the home of a typhoid carrier was discharged into the ground 21 feet away from the contaminated well. Similarly, a septic tank located 50 feet above the spring supplying drinking water to a resort camp in Colorado was found to be the cause of 400 cases of gastroenteritis.

Well Water Wisdom

Signs that suggest you should test your well include:

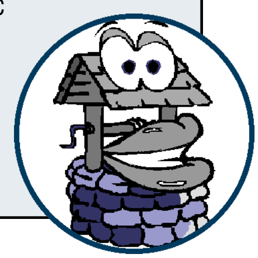
- water with an undesirable taste or smell,
- water that leaves a residue or stains plumbing fixtures or laundry,
- cloudy or colored water,
- corroded pipes or equipment that wears out fast, and
- family members with gastrointestinal distress.



Steps to Reduce Contaminants

The EPA recommends the following steps to protect groundwater supplies:

- periodically inspect exposed parts of the wells to determine any cracking or corrosion or damage to the well casing or cap, and look for settling or cracking of surface seals;
- slope the area around the well to drain surface runoff away from the well;
- install a well cap or sanitary seal to prevent unauthorized entry to the well;
- disinfect drinking water wells once a year with bleach or hypochlorite granules;
- keep records of any maintenance, such as disinfection or sediment removal, that may require the use of chemicals;
- hire certified well drillers for any new construction, modification, or abandonment of wells;
- avoid mixing or using pesticides, fertilizers, herbicides, degreasers, fuels, and other pollutants near wells;
- do not dispose of wastes in abandoned wells;
- do not cut the well casing below the land surface;
- pump and inspect septic systems routinely; and
- never dispose of hazardous materials in septic systems.



Possible signs of contamination may include:

- water that tests positive for coliform,
- unexplained illnesses, such as gastrointestinal problems, hepatitis A, or typhoid, and
- neighbors finding septic system contaminants in their water.

Septic system effluent containing nitrates can pose a health hazard to infants, in particular. Nitrates have been shown to cause methemoglobinemia, known as Blue Baby Syndrome.

Many health officials recommend testing well water in the vicinity of septic systems more frequently when children or pregnant women are present.

Education a Key Component

Homeowner education is a key component in coordinating the management of private water supplies and wastewater treatment systems.

A study that was published in the 1998 *Journal of Soil and Water Conservation* illustrates the need for increased education programs. The study evaluated the water quality habits and beliefs of the approximately three million residents living in upstate New York who rely on groundwater to supply their drinking water and the 1.5 million households there with onsite wastewater treatment systems.

The study surveyed 244 homeowners in three counties. Drinking water was tested, and water supplies and onsite systems were inspected. An average of 32 percent of the drinking water tested positive for coliform. Nitrate levels varied with only two samples having concentrations greater than the current drinking water standard of 10 mg/L.

Despite these statistics, 82 percent of those questioned were satisfied with their water supply, although 31 percent of those satisfied had coliform in their drinking water.

Routine maintenance was also listed in the study as a problem since nearly half of the residents had not tested their drinking water, and more than one-third had never pumped their septic system.

The study concluded that "a general lack of homeowner knowledge suggests the need for increased educational programs targeted to the rural audience, as well as additional research to better understand what influences homeowner perceptions and management practices."

The Final Word

Septic systems and drinking water wells can, and do, coexist harmoniously if the proper precautions are taken. Ultimately, the responsibility is left up to the homeowner.

David Pask, engineering scientist with the National Small Flows Clearinghouse (NSFC), has some additional advice for homeowners who may find that their well supply is contaminated by an existing or new septic system despite compliance with codes.

He said it might be possible to eliminate the problem by installing additional well casing to extend the depth of pumping to below any shallow septic effluent.

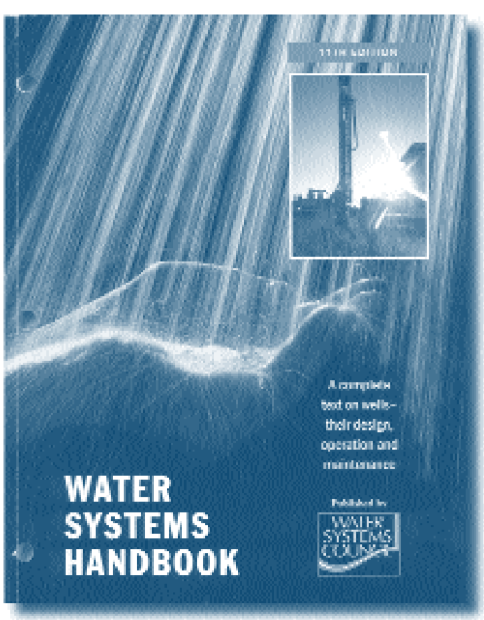
If the well casing was sufficiently below the static water level, it would be advisable to reduce the flow of the well pump by a throttling valve or to install a pump of low capacity. However, a water storage tank may be necessary to allow for sporadic high water demand under a constant low pumping rate.

If all of the compliance regulations have been met and the homeowners' water still persistently tests positive for coliform and other contaminants, they may need to install filtration and disinfection device in the well system for proper treatment.

Reprinted from Pipeline, *Summer 2002, vol. 13., no. 3. NSFC Item #SFPLNL30* .

For more answers to your drinking water questions, contact the National Drinking Water Clearinghouse (NDWC), our sister program.

The NDWC offers *On Tap*, a quarterly magazine; more than 250 free products; a bibliographic database; and RESULTS [Registry of Equipment Suppliers of Treatment Technologies for Small Systems] database. For more information, call (800) 624-8301 or visit their Web site at ***www.ndwc.wvu.edu***



Handbook Available for Well Owners

The 11th edition of the *Water Systems Handbook* is now available from the Water Systems Council. This handbook is a comprehensive technical manual on the proper siting, construction, and operation of wells. It is written for novices in the industry as well as experienced drillers, pump contractors, engineers, and end-users.

The handbook, which was revised and updated this year, includes information that well owners should know—such as details about water sources, well construction, pump operation, well caps, electricial supply, disinfection, and well design. The handbook costs $20, which includes shipping and handling.

To order the *Water Systems Handbook*, log onto the Water Systems Council's Web site at **www.watersystemscouncil.org**, or write to them at Water Systems Council, National Programs Office, 1101 30th Street, N.W., Suite 500, Washington, DC 20007. You also may call toll-free (888) 395-1033 or fax (202) 625-4363.

Septic System Maintenance Helps Keep Vision of Nags Head Alive

NSFC STAFF WRITER

Nikki Stiles

Legend and lore of the 18th century includes tales of land-based pirates who tied lanterns around their horse's necks at night and walked them up and down the beach along the coast of Nags Head, North Carolina. Merchant skippers out in the ocean's waters would mistakenly identify the lights as those of other ships and change course to come ashore. Then these pirates on shore would ransack the naïve skippers' cargo.

Today, however, visitors no longer have to be lured to the beach of Nags Head. In fact, during a typical summer day the population of the town swells from 2,800 to 50,000 people. And with all the sun, surf, and turf, probably the last thing on these vacationers' minds is what they should and should not flush down the toilet. But in order to protect the environment and the integrity of the town of Nags Head, officials are trying to change that mentality through a Septic Health Initiative program aimed at educating residents and tourists about the maintenance of septic systems.

The Town's Vision

Part of Nags Head's vision statement reads:

"The town of Nags Head is working to build a community with an economy based on family vacation tourism. The base of that economy is a diverse supply of accommodations, primarily single-family homes, but including hotel and multi-family dwelling units. Important elements in developing and maintaining this economy are:

- A natural environment typified by clean waters and the natural landscape of sand dunes and salt-tolerant vegetation.
- An ocean-front beach that is accessible, usable, and not blocked by large structures.
- Accommodations that attract and are accessible to visitors from a wide range of economic and social strata.
- Commercial services provided by locally owned and operated businesses that share in the building of the community.
- Recreational amenities and attractions, both commercial and noncommercial, that are wholesome and appeal to a broad spectrum of family members."

In order to preserve this vision of Nags Head as a small, family-oriented vacation spot, the town's mayor, Robert Muller felt that installing a centralized wastewater treatment plant would ignite the town's growth, thus extinguishing the town's vision. To prevent this from happening, Muller knew that steps had to be taken to maintain their current onsite septic systems.

"We've known for a long time that onsite waste disposal was an important element in building a vision of the community," Muller said.

And Muller was not alone in his plight. "Our elected board has made it very clear that they're not in favor of a central or municipal sewage plant," said Bruce Bortz, deputy director of planning and development. "They don't want the high population densities that often occur as a result of the centralized system, and they felt that maintaining and improving our onsite septic capabilities would go a long way in taking away some of the need for a central sewage plant."

Even though town officials and many local residents agreed that the vision of Nags Head did not include a municipal wastewater treatment plant, they were left with the difficulty of how to maintain the estimated 3,000 septic systems scattered throughout the town.

History of the Septic Health Initiative

In the late 90s, Muller, then a town commissioner, put together a committee that he chaired, which included another commissioner, planning board members, and residents. All of them began brainstorming for answers to their wastewater dilemma.

"We spent a lot of time learning about septic tanks and discovered the concepts of decentralized wastewater management and spun our wheels for a while," Muller said.

The town applied for a grant through the U.S. Environmental Protection Agency to conduct a master plan study of the area, but the grant was denied. Therefore, they took matters into their own hands and in1999 developed their own, four-pronged Septic Health Initiative program, which includes an Education Program, Septic Tank Pumping and Inspection Program, Water Quality Monitoring Program, and Decentralized Wastewater Management Plan.

The town receives no outside grant money for the Septic Health Initiative. Instead, the program is funded through the town's water fund. "The program costs $250,000 a year, but when you compare that to the cost of operating a central sewerage system for three to four million gallons of wastewater a day, it's cheap," Muller said.

Educating the Public

With the influx of vacationers and nonresident property owners, one of the most important facets of the Septic Health Initiative Program is the Education Program. Septic Health Coordinator Todd Krafft said that the program educates the public by distributing stickers, brochures, door hangers, pens, and letters to the property owners and the Realtors who rent out properties.

"We have door hangers that say do not flush diapers or cigarette butts, and we try and prevent septic failure that way, but we also try and prevent chemical influence by saying don't flush these types of chemicals and detergents because they could cause problems," Krafft said.

The town takes the educational component of the program even further by making presentations at area schools, organizations, Realtor groups, civic associations, and community associations to educate the public about proper flushing habits, maintaining septic systems, and an overview of the Septic Health Initiative Program.

"We have about 80 or 90 percent of property owners who are not residents and the majority of those come from areas where there is central sewage, so they're not familiar with onsite wastewater disposal systems," Muller said. "That means that we have an educational job to do. Let's tell them about it."

Above: The septic systems along Abram Street in South Nags Head take a beating from stormy weather and have to be monitored closely. Page 18: View of Nags Head from ocean. All photos by Todd Krafft.

Inspecting and Pumping

The Septic Tank Inspection and Pumping Program offers incentives to property and business owners who have their tanks inspected and pumped. Property owners can get their septic tank inspected at no cost by a town-approved contractor. "They inspect things like the age of the tank, type of top it has, various layers of sludge and scum, and any evidence of tank failure or cracking," Bortz said.

If the property owner has the tank pumped, the town will give the homeowner a $30 water bill credit. To assist property owners with failing systems, the town offers low-interest loans of up to $3,000 payable over three years to the property owner to have the system repaired or replaced.

"One of the challenges we have is that we don't have the authority to require people to do these things. So we had to find a way to get them to do it without requirements, and the incentive system has worked well," Muller said.

The town has inspected 700 septic systems so far and has seen a four percent failure rate. Krafft said that of that four percent, half have been repaired or replaced. The town hopes to inspect all 3,000 septic systems within four years.

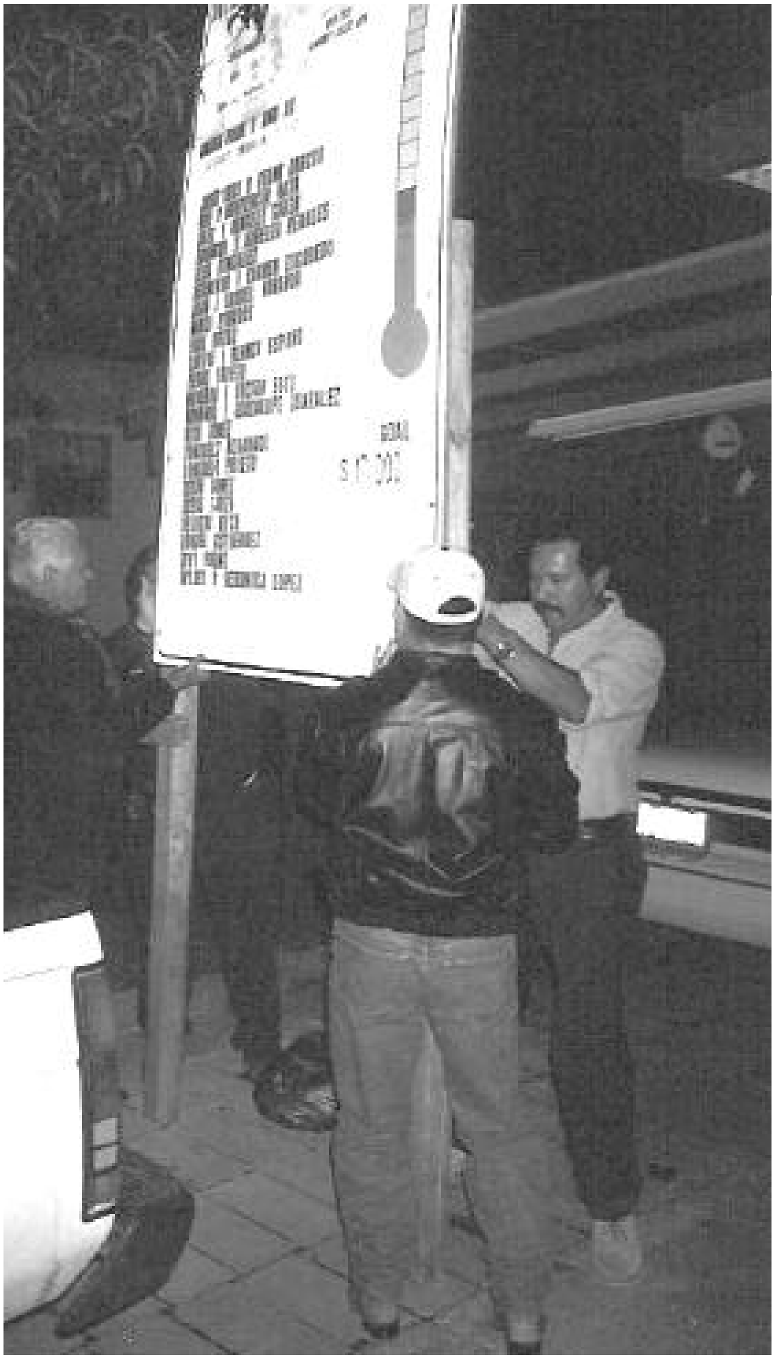
"We have found systems that have not been looked at in 25 years, and we go and inspect them, and they are fine because they were treated by year-round property owners who knew what they were putting down the system. Then we've had systems go in and not even 12 months later they're finished and have got to be completely redone," Krafft said. "What is obvious here is that we don't have flush-and-forget systems. If you treat the system badly, you're going to know about it pretty quick."

Testing the Waters and Gathering Data

To test the effectiveness of the Septic Health Initiative, water throughout the town is tested weekly for fecal coliform, ammonium, nitrates, and phosphorus. "We spend more than $100,000 a year on testing the area water," Krafft said. "We test ditches, canals, the sound side, the ocean side, and the outfalls. Right now, we have 38 different sites that we are testing."

The water is also tested weekly by the North Carolina Department of Environment, Health, and Natural Resources (DEHNR), which began monitoring beaches along the North Carolina coast in a program established in June 1997.

CONTINUED ON PAGE 25



Residents erect sign announcing Amigo Park I and II Neighbors United Project. The sign outlines project and savings goals. Photo courtesy of Eric Ellman

Colonia Residents Take STEPs To Improve Their Community

NSFC STAFF WRITER

Nikki Stiles

For many years, the residents of Amigo Park III Colonia in McAllen, Texas, lived with a constant stench in the air from undersized, failing septic systems. And this odor not only lingered outside, but also crept up through the pipes and engulfed them as they took showers every morning.

"It was terrible. There was an awful smell in the air all the time," said Amigo Park III resident of eight years, Johnny Young. "You couldn't flush toilet paper without filling the tank up, and then you had to clean them out every six months. A lot of people had black water on their property; all and all, it was a very unsanitary situation."

Amigo Park I, II, and III colonias, which lie along the Texas/ Mexico border in Hidalgo County, consists of houses, mobile homes, and trailers. And like many colonias, these homeowners lacked an adequate sewage disposal system, mainly because the homes in Amigo Park had undersized septic tanks and insufficient drainfield areas. The tanks required pumping every six months, adding up to as much as $700 a year to pump the tanks and replace failing drainfields.

As bad as the conditions were, residents of this small, mostly Spanish-speaking community felt powerless to change them until they were introduced to the Small Towns Environment Program (STEP), which enabled them to pull together their resources and manpower to build their own sewer line extension.

Stepping Up to the Plate

Young, who has been a fireman for 23 years and a contractor, recalled the first time he met Hidalgo county STEP agent and deputy director of The Rensselaerville Institute (TRI) South, Eric Ellman.

"Eric came around and said, 'How would you like to get sewer service in here?' and I said, 'I'd love it, but we just can't afford it.' He said, 'There is a way to do it for a very low cost by using your own people,'" Young said.

From that point on, Young began holding neighborhood meetings to see if people were interested and willing to help install their own sewer line extension. "It was a learning experience," he said. "I was out there for about three months just talking to people."

Upon approval by the residents, Young was appointed the "sparkplug" of the project that was thereafter named Proyecto Entre Amigos, which means Among Friends Project.

"A sparkplug is the chief criterion for any of our projects," Ellman explained. "We use the word sparkplug because we like the image of a sparkplug in an engine. It takes the energy from the battery and distributes it to the motor. That is the key requirement for a successful project. We've got to have an energetic, enthusiastic person."

The 26 homeowners in Amigo Park III agreed to each pitch in $300 of their own money, and the rest of the money was collected through fundraising. All together, residents contributed $10,000 and TRI, founders of STEP, awarded the project a $14,000 construction gap grant.

Israel Guerra and Bernabe Lucero unload manholes for installation at the Among Friends Project at Amigo Park III. Photo courtesy of Eric Ellman.

If residents had gone to the city of McAllen to install the sewer line, it would have cost much more according to McAllen City Commissioner, Marcus C. Barrera. "The city could have come in and put in the sewer line, but then our assessment to them would probably be in the $3,000 to $4,000 range per home, and these are very poor people. So what Eric Ellmen and the STEP Program have done is basically help them garner the information to try and do it themselves," Barrera said.

Barrera said the city helped the residents when they could by providing a backhoe and the services of the city engineer. In addition, two local businesses helped out. Contractor Alejandro Aguirre offered his discounted services, and DCR Demolition and Utility donated laser survey equipment, services of a six-man crew, backhoes, front-end loaders, and a water truck.

Young said he took time off from his job, and he and many other residents completely dedicated their time to this project. "We dug holes, we carried rock, and we operated the tractors to carry the rock and sand. It was a lot of hard work, but it paid off because now we don't have the hassle of not having the proper disposal of sewage," he said.

The total cost for the project if built conventionally by hiring a professional engineer, accepting bids for a contractor, and waiting for funds from a state or federal program, might have been $74,000 and taken years. But instead, the residents and the volunteers, by working diligently for eight weeks, managed to lay 1,400 feet of pipe and complete the project for $24,000.

Smoothing Out the Kinks

Since Amigo Park III project was the first of its kind in the city of McAllen, residents had to convince city officials that they could, in fact, install their own sewer line.

"They can only do it if the city agrees to own and operate it. So that was one of the early challenges—to get them to go to the city and say, 'We think we can build this thing and meet your specifications,' because the city doesn't want to want to take it over unless it absolutely meets the same quality of standards as every other professional job," Ellman said.

"It was a real process of discovery between the residents and the city as to how to make it all happen," he added.

Tony Reid, professional engineer and utility manager of water and wastewater systems for McAllen Public Utility, admitted he had his reservations about the STEP Project.

"We think it is a great program, and we want to encourage these people to do that, but our concern is that once the sewer line is in place we have to maintain and operate it on into the future," Reid said. "So if it's not done with the same level of care that we would expect from a traditional construction contractor, then we would end up with something that we are going to have to go back in and work on and replace down the road. That's one reason we want things to be done right."

To assure quality control for the resident volunteers installing the sewer pipe, Reid said that the Public Utility had inspectors at the site to ensure the pipes were being installed properly. And the end product, which included 1,400 feet of sewer pipe and five manholes, was "perfectly fine" Reid said.

According to Barrera, some other problems residents faced were raising money on their own, organizing people who have conflicting work schedules, and filling out the necessary paperwork.

But, Barrera said, the end product is beneficial for both the residents and the city. "These people are having their septic tanks backing up into their homes, and it's unhealthy for them; it's not a good thing for our city to have them. This is a way for the residents to do it cheaper, and the whole community gets involved.

CONTINUED ON PAGE 26

Ohio Provides A New Twist To The Clean Water State Revolving Fund (SRF) Program

NSFC STAFF WRITER

Natalie Eddy

Some Ohio homeowners looking for wastewater treatment improvements may take advantage of lower interest rate loans thanks to a new application of an old loan program.

Initiated in 1987 through Title VI of the Clean Water Act, the State Revolving Fund (SRF) program provides low-interest loans to communities, individual homeowners, citizens' groups, and nonprofit organizations for water quality infrastructure improvement projects.

Administered by the U.S. Environmental Protection Agency (EPA), the SRF program has provided $119.7 billion worth of loans to communities nationwide.

Gregory H. Smith, Ohio EPA chief of the Division of Environmental and Financial Assistance, said the Linked Deposit Financing for Home Sewage System Improvements Program was established to offer another option to homeowners. "We have tried to set up a variety of financing methods to develop the capability of funding as many different projects in as many different ways as we can," said Smith.

"Rather than be faced with a situation of someone coming to us and saying, 'Gee, this is a worthwhile project, but we don't have a way to do it,' we want to have a tool chest of financing programs, mechanisms, and options available to offer them."

Background

The SRF program replaced the now defunct Construction Grants Program, a major source of wastewater treatment improvement funding in the 1970s and 1980s. The program provided more than $60 billion toward the construction of public wastewater treatment projects in thousands of communities nationwide.

That program, also managed by EPA, led to an improvement in water quality, significantly improving the nation's wastewater treatment infrastructure.

However, in the 1987 amendments to the Clean Water Act, Congress set 1990 as the last year that grants would be provided.

With the phaseout of the program, EPA changed municipal financial assistance from grants to low-interest loans provided by state revolving funds.

The "revolving" nature of the program ensures its continuance by making sure that as loan payments are made, funds are recycled to support additional water quality projects.

SRF funding allows states to achieve their highest priority water quality needs. It is used most commonly for wastewater treatment systems (including decentralized systems), nonpoint source controls, and estuary protection.

EPA disburses funds to the states, allowing them to set priorities on their own projects. EPA provides grants or "seed money" to all 50 states plus Puerto Rico to initiate the state loan funds. As the money is repaid to the revolving fund, new loans are made for similar projects.

The states then make loans to municipalities, individuals, and others for high-priority water improvement activities.

Ohio's Linked Deposit Financing Program

Ohio's unique way of disbursing the SRF funds offers advantages to the EPA, the state, local banks, and individual homeowners seeking to repair or replace their wastewater treatment system. The linked deposit program is similar to the traditional SRF program with one main difference—the state EPA passes its role as the lender on to a local banking institution.

Smith said a conventional homeowner SRF loan is similar to the process of buying a house. With the traditional SRF, an applicant proposes a project. Through a long process, the state EPA and the local health department then determine the feasibility of the proposed project, review the applicant's credit worthiness, and then complete paperwork making sure the loan is sound before finally setting up the terms of the loan.

"With the linked deposit program, we carve the whole process in half," said Smith. "If an applicant steps forward, you look at what kind of water quality improvement project that applicant is proposing and make sure it is appropriate. When it comes to the financial side of it, you have an arrangement with a local commercial lender to take care of the lending responsibility."

Smith said a meeting is set up with the applicant's local bank of choice. "We tell the bank we have a potential borrower and that we are willing to subsidize the loan if the project is funded," said Smith.

"Instead of entering into an agreement with us where we hand the money over and the applicant pays money to us, we put a commercial or regional bank into the position of doing that as our partner."

The SRF Linked Deposit program sets up a contract with the bank to place the money for the proposed project into a certificate of deposit (CD) at a lower rate of interest with the stipulation that the same rate of interest is deducted from the homeowner's loan.

"For example, if our CD will earn 4.5 percent, we will agree to accept 0.5 percent interest on the condition that the bank passes that 4 percent discount onto the borrower," said Smith.

"The homeowner then ends up taking out the loan through the bank for the home sewage system improvements for five years. For instance, instead of paying 8 percent interest, the homeowner receives the loan at 4 percent interest."

Smith added that this process puts the responsibility of credit reviews and paperwork on the bank instead of the EPA.

"This approach offers advantages to everyone," he added. "Homeowners get to work with their own lending institution, as opposed to the state of Ohio. Instead of making trips to Columbus or making long distance telephone calls, they can visit the bank of their choice.

"The bank also wins. As a benefit of the 'buy down,' the bank gets a local customer, and it also charges its normal fees and makes the same amount of money as it would on a loan if we weren't involved."

Smith continued, "From our standpoint, we don't have to engage in a lot of relatively small-dollar transactions. We don't have to do a credit history analysis and a determination of credit worthiness. That's left to the bank. And the big benefit to SRF is that there is no risk in making that loan if the borrower should default.

"We have lower transaction costs, less risk, and we still see the environmental improvement. In fact, we provide the incentive for that improvement to take place."

A Homeowner's Viewpoint

Steve Papesch, a homeowner from Orange Village, Ohio, was one of the first applicants of the program. "It worked out really well for us. It was a smooth transition to get the financing. It was very easy, and the lower rate always helps," he said.

Papesch's took out his loan in March 1999 when the normal interest rate at his lending institution was 9.75 percent. At that time, the EPA allowed up to a 3 percent discount. He was able to secure the $7,500 loan at 7.56 percent interest, saving more than 2 percent interest.

Jerry Rouch, Ohio EPA environmental specialist, said the allowable amount of interest a homeowner currently can save on a loan has been raised from 3 percent to up to 5 percent interest. He added that today many of the program's interest rates are much lower.

Outline of the Process

In Ohio, the first step in the program is for homeowners to contact their local county health department and present their proposed project.

If the proposed improvements meet the health department criteria, it issues a "certificate of qualification" to homeowners, who then take the certificate to a participating bank in their area and apply for a loan.

If the homeowners qualify for the loan, the bank requests an investment of the loan amount from the Ohio EPA, which the Ohio EPA then deposits the funds in the bank at a reduced interest rate, which the bank passes along to the homeowners.

How the Program Began

The idea for the program originated with agricultural borrowers in 1994. "About five years ago, we started applying the concept to home sewage systems through a partnership with the local health department," Smith said. "We rely on local health departments to review an applicant's proposal to make sure it complies with sanitation requirements."

Smith said he was uncertain if other states are using the program for homeowner wastewater treatment projects, adding that some have begun using a similar program with agricultural borrowers.

"We were the first SRF to use this concept," he said. "I don't know whether anybody else is applying it to small systems."

Although no municipal loans have been processed this way, Smith said it would be possible. "We've never had anybody ask to do it that way, but we could consider it," he added.

How Much Money Was Loaned

To date, Ohio has helped finance $210,410 worth of homeowner wastewater treatment improvement projects. The average per project amount is approximately $7,000.

The linked deposit program is established in four of Ohio's 88 counties—Mahoning, Cuyahoga, Perry, and Clermont counties. "There are a number of other counties, at least a dozen, that are in the planning phase to begin the program," said Rouch.

"Of the four counties involved in the program, there only has been activity in two of them, Mahoning and Cuyahoga counties. Delays in the other two counties have prohibited initiation of the program."

Mahoning has awarded 24 loans (totaling $171,565) since the fall of 1997. Cuyahoga County's program, which started a year later, has awarded six loans, totaling $38,845.

Permitting Problem Causes Glitch

Part of the problem the counties have experienced in getting the program off the ground is a regulation glitch. Rick Novickis of the Cuyahoga County Board of Health said the program has not been as successful in Cuyahoga County due to an EPA restriction that the money cannot be used to fund improvements for off-lot discharges until a general National Pollutant Discharge Elimination System (NPDES) permit is issued.

Systems that are currently eligible to be used in the linked deposit program are those that do not create a discharge. "If it goes off of the property, whether to a stream or storm sewer, a discharge is generated," Novickis added.

"The hope is that the EPA will allow the use of properly designed discharging systems as replacement systems and allow them to be eligible for funding."

The Cuyahoga County Board of Health is located in Northeast Ohio, and services 830,000 residents in 56 communities, excluding Cleveland, Lakewood, and Shaker Heights.

Novickis said the area is predominantly urban and well developed, containing 35 cities, 19 villages, and two townships.

"Many of our lots were developed over 40 years ago," he added. "We are talking about lots the size of a quarter of an acre and under, where a driveway and a house take up a good portion of the property, and there is minimal room left for an onsite system. Because of this limitation, there are not too many options.

Unfortunately, Ohio has no permitting process in place for off-lot discharges. Rouch commented, "This means that they are 'unpermitted discharges to waters of the state,' so the Ohio SRF is unable to fund them. Ohio has recently tried to develop a general permit for these situations, but it is not yet in place.

"A majority of our neighboring states either require permits or completely prohibit off-site discharges," Smith said. "From a pollution control standpoint, we would like to assist improvements to all types of failing home systems. But we would be remiss if we supported point source discharges that don't have legally established performance and operation requirements."

This presents a particular problem for Cuyahoga County where many of the lot sizes are small. "When the program was originally set up, a good portion, if not all, of the systems that were found to be in failure were located on smaller lots that were in need of replacement systems," Novickis said.

"Even though these failing systems are emitting bad, foul-smelling, black effluent, and the proposed repairs were properly designed for replacement use, we could not get them a linked deposit loan because of a technicality."

This technicality has caused dozens of applicants in Cuyahoga County to be turned away because of small lot sizes, according to Novickis.

Although an NPDES permit is typically issued for larger plants and commercial systems, Novickis said the permit they seek is a statewide permit to cover only discharges from household sewage treatment systems.

"Homeowners in Ohio, through their local health departments, would seek coverage under this general permit and try to obtain approval for design and installation of these systems," he said.

The majority of systems currently in use include filter bed and aerobic systems. Novickis said that for new development and on larger lots, nondischarging onsite systems such as mounds and shallow leaching trenches are utilized.

Another Application Found

Mahoning County also has a problem with the off-lot discharging permit and smaller lots in the county.

Located in Youngstown, Ohio, along the northeast border of Pennsylvania, the Mahoning County District Board of Health services approximately 154,000 residents in 14 townships, including one city and seven villages.

Christine Frankford, chief of the Mahoning County District Board of Health Waste Control Program, commented, "We have the same problem in some areas as Rick Novickis in Cuyahoga County. There are some places where there is not enough room on the lot to meet system standards."

Frankford said that when they began using the program in 1998, they initially solved the problem of small lots by using aeration treatment systems with off-lot discharge. "At some point in time, EPA said we had to stop because they were trying to eliminate off-lot discharges. That shut us down for awhile," she added.

"That's when Health Commissioner Matthew Stefanek went to EPA in Chicago and asked to use the money for sewer tie-ins. We got off to a slow start, but we are making more loans now that can be used for sewer tie-ins."

Cuyahoga County has also expanded its program to incorporate sewer tie-ins. "It is a benefit to be able to speak to community leaders and homeowners at the time of a sanitary sewer installation to offer a linked deposit program to people who will have to fund and pay a contractor for any tap-in fees or abandonment fees for existing septic system removal," said Novickis.

"It can be used to help offset the cost of the sewer line from the house to the right of way and pay for the crushing and proper abandonment of the old system. Everything can be paid for with this type of loan, except the sewer assessment itself."

A Final Look

Despite the permitting limitations, Frankford and Novickis believe the linked deposit program will grow.

"We worked closely with EPA to have the program implemented. I think it is still going to be successful," Novickis said. "It is a good program, and it is worth the effort to establish it. We are eager to replace systems that are discharging raw sewage and take them up to clear and odorless standards with a substantial reduction in the pollutants reaching receiving streams."

Frankford agrees. "I believe it's a very good program. A lot of people here have taken advantage of it and gotten good interest rates. One of the latest loans was down to 1.5 percent interest. It has helped people out, and I'm hoping more people will begin using it. I think a lot more people are going to be interested in it in the future," said Frankford.

Novickis also points out that although only six residents secured loans through the program in Cuyahoga County, "many other people qualified and walked into a bank to take out a linked deposit loan and instead secured another type of loan because of other financial needs they might have had."

He said, "There are many people we know of who left with a different type of loan. Whether or not they used the linked deposit loan, it was the mechanism to get them into the bank. It's a win-win situation. We are getting the systems replaced, eliminating pollutants to the environment, and homeowners are helped with a financial solution."

For more information on Ohio's Linked Deposit Financing for Home Sewage System Improvements program, contact Smith or Rouch at (614) 644-2798. For additional information on Cuyahoga County's program, call Novickis at (216) 443-7520.

The NSFC offers SRF and other funding information

The following resources from the National Small Flows Clearinghouse (NSFC) provide information about funding options. See page 45 for more wastewater funding and financing products and page 51 for ordering information. (Shipping charges apply.)

Hardship Grants Program for Small Communities. Item #FMFSFN27. 2 p. $0.00.

Clean Water SRF: How to Fund Nonpoint Source and Estuary Enhancement Projects. Item #WWBLFN01. 17 pp. $0.00.

Protecting Wetlands with the Clean Water SRF. Item #FMFSFN31. 2 p. $0.00.

Cleaning Up Polluted Runoff with the Clean Water State Revolving Fund. Item # FMFSFN30. 2 p. $0.00.

CONTINUED FROM PAGE 19

As part of the Septic Health Initiative Program, contractors do an inspection of a homeowner's septic system.

All of the data gathered from the water testing and septic system inspections by the town are compiled to make up the final part of the initiative, which is the development of a Decentralized Wastewater Master Plan. This program is a long-term strategy that will allow the continued use of onsite systems in the town without impacting the water.

Importance of Getting the Word Out

Since the Septic Health Initiative is a voluntary program, and the town has no authority to enforce any part of the program upon residents, officials had to let the public know that the program was out there and gain support.

The town was able to achieve this through direct mailings to residents, by publicizing it in the town's quarterly newsletter, radio and television interviews, newspaper advertisements, and public presentations.

"We want folks to understand how we envision the role of onsite septic systems in our community. We think it's a key part in our strategy to keep our community relatively small, with low density, yet still have clean water, clean ocean, and clean sound around us because our economy is based on folks coming down here and going to the beach. If we lose that clean water, then we have nothing to sell," Muller said.

Ahead of the Curve

"We didn't have water quality problems. This whole effort was to get there ahead of the curve," Muller said. "The genesis was much more proactive. We wanted to find an answer and have a plan on board before we were driven to do something and that's not uncommon for Nags Head."

For instance, Muller said the town received a national award for a hurricane damage storm mitigation program they developed in the mid-80s. "It's not uncommon for the town to be looking five or 10 years ahead and identifying problems and trying to find solutions to those problems before they become major crises that we have to deal with," he said.

For his contributions to the Septic Health Initiative, Muller received a Distinguished Leadership Award at the annual North Carolina Marvin Collins Planning Awards Banquet Ceremony in May 2002.

"It's been a gleam in my eye for a long time, but there were a lot of people who worked on it, and I accepted the award on behalf of the entire committee and the entire town," Muller said.

Results of the Program

Educating the vacationers with door hangers and literature in rental properties seems to be having some effect. "In the fall, after the first summer the program was in full process, one of the real estate companies came to us and said they had 50 percent fewer septic problems in Nags Head than they did the previous year," Muller said.

Many residents are taking advantage of the free inspection and having their septic tanks pumped and repaired. "We had a system at a store that was probably built in the 1940s, and the wastewater was straight piped into a wooden box with a sand bottom. I don't think there was a drainfield," Muller said. "These folks came to me and knew they had this and wanted to take care of it."

Another resident who has taken advantage of the Tank Inspection and Pumping Program is Shirley Garrett, who has lived in the town for five years and has maintained a rental property there for more than 20 years. Garrett said that through the program she had the septic tank inspected and pumped at her rental property.

"It is a great program. I really applaud the town of Nags Head for initiating it," she said. "I feel very fortunate that this was accomplished before we had any problems. It's a nice feeling to know that it is pumped out, and I don't have to wonder if it is full. It gives me the sense of security to know that we shouldn't have any problems for several years."

"We get very good customer/citizen support from it. It is one of the few programs that the government can run that makes our citizens happy," Bortz said, laughing. "They all speak very favorably of it. I don't think we've had any negative comments about the program. We are helping them financially to get their systems pumped, and at the same time, it's helping the town, and it's helping the environment. So it's really a win, win situation."

For more information on the Septic Health Initiative contact Todd Krafft at (252) 449-6047 or e-mail to **krafft@townofnagshead.net**.

Septic Health Coordinator Todd Krafft and Helen Mattioni, a water quality contractor with Environmental Professionals Inc., conduct water quality monitoring of a site in Nags Head to check levels of nutrients and fecal coliforms.

CONTINUED FROM PAGE 21

I think it's going to have indirect positive results for the community in the end because they can organize and do other things as well," he said.

Stepping Out With the Neighbors

"It really all is an exercise in reinventing citizenry and creating community through sewer building," Ellman said of STEP.

In the 1970s, STEP was created by The Rensselaerville Institute, a nonprofit development center near Albany, New York. Since then, TRI has pioneered self-help techniques for solving water and wastewater problems as well as problems of housing and human services.

However, that is not the only goal of TRI, as Ellman explained. "Our real goal is not even water or wastewater. Our real goal is building better, stronger communities. Our operative theory when we got into this 30 years ago was to ask, 'What's the best way to turn a bunch of strangers into a community?' and the answer we came up with was to get them to work together on a shared problem and be successful at solving it."

But does this philosophy work? Ellman said, "Yes it works. We've got project after project where people have gone on without us after that project was completed to identify other priorities and then deal with them."

And Amigo Park III resident Young has seen the indirect effects that building the sewer line has had on his community, a community in which, before the project, residents didn't even know their neighbors' names.

"We know everybody by first name now. Before, they would just go by, and we'd wave at them and that was about the extent of it. We really didn't know our neighbors," he said. "But when you get into a project like this and start working, and everybody has to talk to each other, it becomes one big family. We got to the point where whichever house we were in front of, they would feed us that day. And the next day, we went further down the street, and whoever's house we were in front of, they would feed us."

Young said that now the residents are planning on updating their water system next. Currently the community has six-inch main pipes, and residents hope to upgrade the pipe with an eight-inch pipe to increase water pressure and permit fire hydrants to be installed.

Following in the Footsteps of Amigo Park III

Upon seeing how using a little elbow grease paid off for Amigo Park III, residents in Amigo Park I and II, which include 47 homes, decided to band together on their own project to install sewer pipes, which became know as Proyecto Vecinos Unidos or Neighbors United Project.

Ellman said that Amigo Park I and II have worse sanitary problems than Amigo Park III when it comes to failing septic systems. "Their lots are about one-third the size, so everyone has to discharge their graywater into their yards, and waste goes directly into a shallow water table," he said.

After organizing, the residents sold 3,500 raffle tickets and raised $7,000. In addition, the residents held a community yard sale to raise money and contributed $5,000 (each of the 47 homes contributed $150) of their own money. Additional funds came from the city, which contributed $10,000, and TRI, which contributed $8,000. Ellman said this project as with most self-help projects done this way versus conventional methods, yields about 40 percent savings.

"The money is just part of it," Ellman said. "The real part is all the organizational experience that they will get just by organizing the raffle, getting everybody in the neighborhood to sell 100 tickets—this forced them to get to know one another and facilitated organizing of the rest."

Since the Amigo Park III project was a success, city officials now know what to expect, and things are going much smoother for the Neighbors United Project. Ellman said the project just broke ground and is expected to take two months to complete.

"The city contributed to the engineering, the residents did the survey themselves and are going to provide most of the labor and found a school training program that wanted to give students experience with heavy equipment skills," he said.

Another improvement from the previous project, Ellman said, is that the Texas Water Development Board would reimburse the residents for money they contributed because they raised enough money through the raffle to cover the components of the system that are on their property. Also, the city of McAllen Public Utility approved an insurance policy to cover all of the volunteers for the project.

Self-Help Approach Yields Results

By the late 1990s, the STEP approach had been used in nearly 400 communities in 17 states, with cumulative project cost savings of over $45 million.

"The STEP Program has been great because it empowers the people to do the projects, but it doesn't do it for them. The program encourages them to think and find solutions to their problems," Barrera said. " It is a unique program for these people down here—they would never be able to afford it if it were not done this way."

And Amigo Park residents have learned that a little sweat equity pays off in more ways than one. Not only have their neighbors become their friends, but now they all can enjoy a breath of fresh air.

For more information on STEP, contact Ellman at (956) 661-1661 or e-mail to **eric@trisouth.or g**.

Performance Evaluation of a Recirculating Sand Filter and Peat Filter in West Virginia

CONTRIBUTING WRITERS

James Ebeling, Ph.D., Scott Tsukuda, Joseph Hankins, and Clement Solomon

ABSTRACT: As part of an Environmental Protection Agency (EPA)-funded National Onsite Demonstration Project (NODP) for small communities (Phase III), the Conservation Fund's Freshwater Institute in Shepherdstown, West Virginia, installed an onsite wastewater treatment system employing two different secondary treatment technologies: a peat filter and a recirculating sand filter. The project goals were to design and install, from an environmental sustainability perspective, a wastewater treatment system for a new research and office building to prevent nutrient and fecal contamination of an existing artesian spring. In addition, the project could also be used for research and public education. After an initial start-up period, the performances of the two systems were extensively monitored for a year using both standard water quality analysis and a real-time monitoring system. The effectiveness of the two systems was demonstrated by their ability to remove pollutants from the wastewater, including biochemical oxygen demand (BOD_5), total suspended solids (TSS), fecal coliform bacteria, and nutrients nitrogen (N) and phosphorus (P). The sand filter produced an effluent with the following average characteristics: 9.8 mg/L BOD_5, 9.9 mg/L TSS, 22.1 mg/L ammonia nitrogen (NH_4-N), 8.2 mg/L nitrate (NO_3-N), 27.9 mg/L total nitrogen (TN-N), 6.0 mg/L total phosphorus (TP-P), and 8,600/100 mL fecal coliforms. Average characteristics for the peat filter effluent were 2.2 mgL BOD_5, 5.9 mg/L TSS, 15.2 mg/L NH_4-N, 30.1 mg/L NO_3-N, 61.5 mg/L TN-N, 6.6 mg/L TP-P, and 1,600/100 mL fecal coliforms. Both systems were hydraulically loaded at two levels (50 percent and 100 percent design rate) and at the highest loading, the peat filter hydraulically failed. Due to a series of operational problems, both systems showed a wide variation in effluent characteristics. The recirculating sand filter was moderately effective in removing nitrogen with an average 58 percent removal rate over the monitored period, while the peat filter—with no recirculation—only removed on average 26 percent of the nitrogen. The monitoring of the two systems will continue under different loading scenarios and operating conditions with and without recirculation.

Keywords: peat filter, recirculating sand filter, denitrification, performance evaluation

This study examines the performance of two onsite wastewater treatment systems, a peat filter and a recirculating sand filter, located in Jefferson County in the Eastern Panhandle of West Virginia. Jefferson County has over 11,000 septic systems. The area is convenient to employment in neighboring Berkeley County (which has over 17,000 septic systems), as well as the metropolitan areas of Northern Virginia, Baltimore, Maryland, and Washington, DC. Commuter rail service and lower land prices and property taxes make the area a preferred residential location. The county is moving from an agricultural base to one of rapid residential and service industry growth, as people relocate to this primarily rural county.

Currently 58 percent of the population of Jefferson County employs septic systems to treat their household wastewater. As the county's population rises, so will the number of systems and their impact on groundwater resources.

The geologic framework of the region is composed of Conococheague Formation soils, with a prevalence of limestone and dolomite rock. Although the soils overlaying the aquifer are only moderately permeable, surface runoff is negligible. Water percolating into and through the carbonate rocks dissolves rock materials and enlarges minute fractures in the rock strata. Dissolution has produced a karst system containing caves, springs, disappearing and underground streams and a land surface that is, in places, dotted with sinkholes. Groundwater recharge in karst geology can be rapid and direct through sinkholes, caves, and streams, or indirect through infiltration and deep percolation of precipitation. As groundwater velocities are rapid in such karst systems, a large part of the aquifer can become contaminated in a short period of time (Kozar, et al., 1991).

The quality of karst groundwater is directly related to land-use within the recharge area. The close connection between surface and groundwater in karst areas makes this groundwater resource as contamination prone as surface streams.

The most commonly measured constituents of water degradation are nitrate and fecal bacteria. The EPA 1990 maximum contaminant level (MCL) for nitrate as N is 10 mg/L. Studies in Jefferson County found median nitrate concentrations of 5.8 mg/L and a mean concentration of 8.2 mg/L (Kozar, et al., 1991). The same study found that 26 percent of the 1988 samples exceed the EPA 10 mg/L nitrate drinking water standard. In addition, 53 percent of the samples contained fecal coliform bacteria and 70 percent contained fecal streptococci bacteria.

The site for the two demonstration projects featured abrupt outcroppings of limestone and slopes that make long level runs of piping for leachfields challenging to locate and install. The site also contains a large artesian spring flowing at 600 to 1,200 gallons per minute, used by the Freshwater Institute to support a large aquaculture research center. The spring is downgrade, and within 1,500 feet of the demonstration site.

Staff members at the Institute had expressed concern about the potential for cross-contamination of the spring water resource used for research. Traditional septic tank and leachfield systems are designed to remove biosolids and biochemical oxygen demand (BOD), but have very little impact on phosphorus and nitrogen. The primary purpose of this NODP Phase III project was to design and install an onsite wastewater treatment system that would treat the black- and graywater generated by the research facility in a manner appropriate for the long-term health and sustainability of this karst groundwater resource.

As part of EPA's NODP Phase V, a real-time monitoring system was added to the existing two demonstration systems. The objectives of this project were to display real-time wastewater data on the Internet for use as an educational tool to improve the understanding of innovative and alternative systems, to evaluate the feasibility of using telemonitoring in management districts with many small independent treatment systems, to investigate the maintenance requirements of specific probes, and to demonstrate how alternative measurement parameters correlate to conventional indicators for monitoring system performance.

In this paper, performance data for the two alternative systems are presented for the first 12 to 16 months of operation. The effectiveness of the two systems was determined by their ability to remove pollutants from the wastewater, including BOD_5, TSS, fecal coliform bacteria, and nutrients (N and P).

MATERIAL AND METHODS

The Jefferson County public health department required that a traditional septic system be installed before any "alternative systems" would be considered. The traditional septic system consisted of a primary 1,500-gallon, two-compartment concrete septic tank and a standard leachfield, plus additional space dedicated as an alternative leachfield site. As part of the alternative system design, the primary septic tank was used for traditional

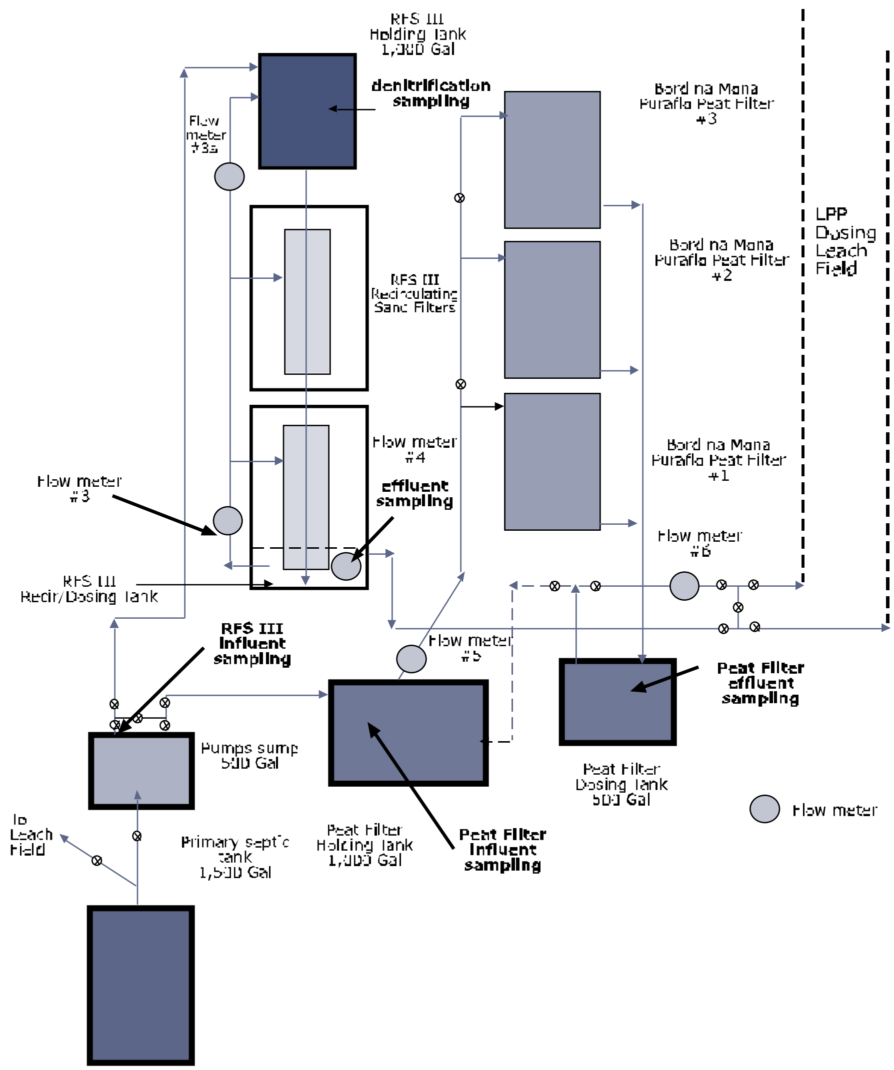


Figure 1 Schematic of the Two Demonstration Systems

solids separation, and the septic tank effluent then flowed into a 500-gallon concrete pump sump. From this pump sump, septic effluent was pumped to the two alternative secondary treatment units and then into a shallow, low-pressure dosed drainfield (Figure 1). The two alternative secondary treatment systems were a recirculation sand filter designed by Ashco-A-Corporation and a Puraflo® peat filter designed by Bord na Móna Environmental.

Recirculating Sand Filter

The RSF III recirculating sand filter (Figure 2) was designed and installed by Ashco-A-Corporation (Morgantown, West Virginia). This is a package system consisting of two 1,000-gallon concrete septic tanks that have been modified for use as a recirculating sand filter. The sand in this system is similar to pea gravel, and is called Black Beauty, which is a byproduct of coal combustion (i.e., coal slag), and has an effective size of 1.00 to 1.70 mm with a uniformity coefficient of less than 1.90. Sand filter surface area is dependent to some degree on the type and size of the septic tank, and ranges from 110-140 sq ft. The septic tank effluent flows by gravity from a 1,000-gallon denitrifying holding tank (described below) into the recirculation tank "bottom zone."

The two septic tanks are connected by two 6-inch pipes, allowing the effluent to flow through the bottom zone to the pump sump, located at the far end of the second septic tank and separated from the sand filter by a concrete partition wall. Located in the sump is a 1/2 hp, single-phase, 240 VAC, cast iron sump pump, which pumps the effluent via a spray grid onto the surface of the sand filter (110 sq ft).

There are six spray orifices per cell with a design flow rate of 3.0 gpm/spray head. These spray heads are incorporated in the septic tank concrete lid and have a large orifice (3/8 inch), which minimized potential for clogging. Recommended hydraulic loading rates range from a low of 2.8 gpd/sq ft to a maximum of 5 gpd/sq ft.

Bacteria attach themselves to the sand media and extract food and nutrients as the wastewater effluent flows through the media. This mechanism of treatment is a combination of biochemical and physical filtration and chemical adsorption. Suspended solids are filtered out. Bacteria convert organic matter to carbon dioxide and water. Organic nitrogen and ammonia are converted to nitrite and then nitrate under aerobic conditions. The lids of the two septic tanks are partially open to the atmosphere and are covered with a galvanized grating and a layer of wood chips. This provides for the free flow of oxygen and gases in and out of the filter and access to the sand bed and spray orifices.

After passing through the biological filter media, the treated effluent is stored in the bottom zone, where it is combined with the effluent from the septic tank before being applied again to the sand filter. By diluting the strength of the septic tank effluent, higher application rates (3 to 6 gal/ft^2/day of the forward flow) can be applied to the filter.

The design recirculation ratio suggested by Ashco-A-Corporation is 12:1, implying a dosing rate of 3,600 gpd, based upon a forward flow rate of 300 gpd. More conservative designs suggest a 3:1 or 5:1 recirculation ratio (Crites and Tchobanoglous, 1998), suggesting a dosing of 1,000 to 1,500 gpd. A timer on the dosing pump is used to turn on the pump every 30 minutes for 2 to 3 minutes. The set of "on-off" control floats is arranged so that there is always a minimum depth of water in the pump sump for the recirculating pump.

Since the recirculated flow loops through the sand media and returns to the sump pump, there is always adequate recirculation of effluent, even with no forward flow through the system. Using this scheme, the sand filter is always loaded with the same volume of water everyday, regardless of the forward flow rate.
Only the organic strength of the recirculated effluent varies with more or less forward flow through the system. Thus the sand always has a thin film of wastewater covering it and operates in a steady-state mode, maximizing its efficiency. A second 1/2-hp, single-phase, 240-VAC, cast iron effluent pump in the sump is also on a timer, and doses the shallow, low-pressure-dosed drainfield.

Figure 2 **Installing the Recirculating Sand Filter**

RSF III Denitrification System

A 1,000-gallon holding tank was included as a "front end" of the system, where denitrification takes place. This tank simulates a standard septic tank in a traditional system design and received a portion of the septic tank effluent from the primary 1,500-gallon tank.

The recirculating dosing pump recirculates a portion of the sand filter effluent (high in nitrate) to this holding tank containing septic effluent (high in organic carbon). The long hydraulic retention time (HRT) in this tank provides for an extended contact time between the septic effluent and the recirculated sand filter effluent. The high organic loads ensure anoxic conditions and provide an abundant carbon source for the denitrifying bacteria.

Peat Filter

The second treatment unit is a Puraflo® peat filter (Figure 3) designed by Bord na Móna Environmental (Greensboro, North Carolina) consisting of three pre-engineered modular peat units. The peat filter uses biofibrous peat to treat septic tank effluent. Peat is partially decayed organic matter mainly of plant origin. It has been used as a medium for wastewater treatment intermittently since the last century (Puraflo, 2000).
The peat filter treatment technology is based on simple, passive biofiltration principles, achieved by a combination of physical (filtration and adsorption), chemical (adsorption and ion exchange), and biological (microbial

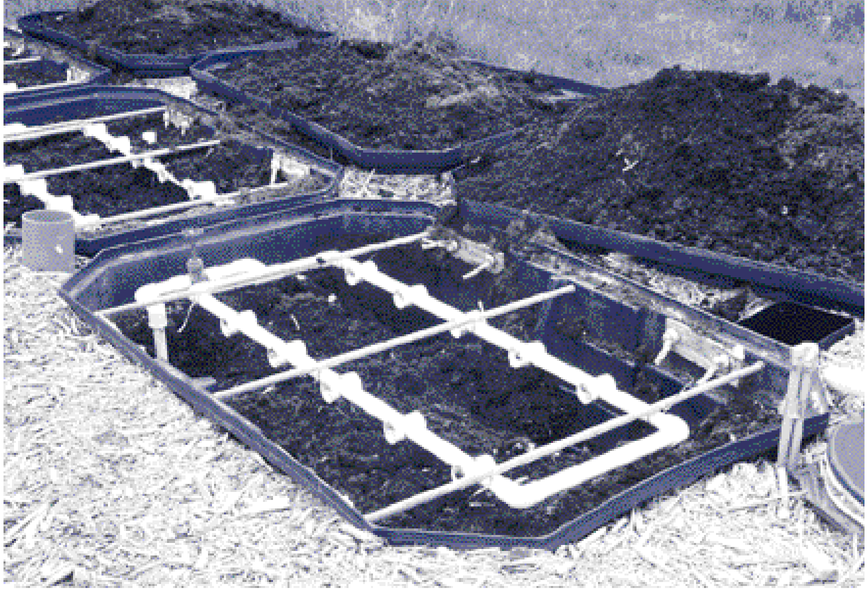


Figure 2 **View of the Peat Filter Showing Distribution Manifolds**

assimilation) interactions between the wastewater and the fibrous media.

The biofilter modules are pre-assembled and pre-engineered for a hydraulic loading rate of up to 150 gallons per day per module and an organic loading of 0.3755 lb/day. This is a design hydraulic loading of approximately 5.6 gpd/ft^2 and an organic loading of 0.0140 lb/ft^2/day. An on/off timer controller pumps septic tank effluent into a 1,000-gallon holding tank. Located in the sump is a 1/2-hp, single-phase, 240-VAC, cast iron effluent pump, which pumps the effluent via a PVC spray grid onto the surface of the three peat filters (Figure 3). The effluent from the three peat filters then flows by gravity into a 500-gallon dosing tank. A second 1/2-hp, single-phase, 240-VAC, cast iron effluent pump in the sump is on a timer, and doses the shallow low-pressure-dosed drainfield.

The physiochemical properties of peat make it an effective treatment media. Peat is partially decayed organic matter, consisting of the partly decomposed remains of roots, stems, leaves, flowers, fruits, and seed. One of the most important characteristics of peat is its ability to retain and hold water. This natural water holding ability allows for long hydraulic residence time (36 to 48 hours) of the wastewater in the biofilter treatment process (Puraflo, 2000). In addition, the treatment of wastewater by peat is influenced by its very high cation exchange capacity, the creation of an acidic environment, and the antibiotic and disinfectant properties of the material. Finally, the bulk of the treatment process is achieved by a diverse microfauna, which adheres to the surface of the peat media (Puraflo, 2000). This is largely composed of aerobic and facultative aerobic heterotrophic bacteria. Also, a wide variety of higher life forms coexist in the peat media, including protozoans, rotifers, nematodes, worms, insects and their larvae. These organisms help to maintain a balanced ecosystem in the peat filter.

Peat Filter Denitrification System

Like the sand filter, a 1,000-gallon holding tank was also included as a "front end" for the peat filter. This tank simulates a standard septic tank in a traditional system design and received a portion of the septic tank effluent from the primary 1,500-gallon tank. The leachfield dosing pump can be configured to recirculate a portion of the peat filter effluent, which is high in nitrate, to this holding tank containing septic effluent wastewater, which is high in organic carbon. The long hydraulic retention time (HRT) in this tank provides an extended contact time between the septic effluent wastewater and the recirculated peat filter effluent. The high organic concentration in the septic tank effluent assures anoxic conditions and provides an abundant carbon source for the denitrifying bacteria.

Low-Pressure-Pipe (LPP) Dosing Leachfield

Treated effluent from the recirculating sand filter and the peat biofilter were applied to two independent low-pressure-pipe (LPP) dosing leachfields. Since the effluent had already been treated, these two fields had only to hydraulically absorb the effluent, and provide minimal additional treatment.

A pressure distribution system has the advantages of providing a uniform small dose to the entire absorption area, promoting unsaturated flow, and providing a consistent drying/reaeration period between doses. The modified LPP system utilized an Infiltrator Equalizer chamber system (Infiltrator Systems, Inc., Old Saybrook, Connecticut). The Infiltrator chamber system consists of lightweight units that are easy to assemble and install in a shallow trench (Figure 4). The louvered sidewalls and the open chamber bottoms allow for infiltration, and the high-density polyethylene constructions make them lightweight and durable.

The distribution system consists of 1.5-inch PVC pipe lateral lines with 0.5-inch diameter orifices at 5-ft intervals, 6 facing up, and 3 down. The lateral lines are attached to the underside top of the chamber system (Figure 4), which in turn is buried in a 2-ft-wide trench, approximately 2 ft deep. The two pressurized drainfield dosing trenches are 50 linear feet long with a maximum loading capacity of 3 gpd/ft^2 or 300 gpd per drain line. Dosing design rate was determined to be approximately 30 gallons/dose.

Several observation ports were included, as well as sampling ports for each lateral. In addition, the dosing leach system was designed with crossover valves to allow additional options, such as isolation for recovery studies or flow doubling through a single lateral to study hydraulic parameters of the leachfield.

System Flow Control

The dosing pumps in the pump sump, recirculating and dosing pumps in the recirculating sand filter, and peat filter sumps initially were all controlled by simplex pump controllers designed by QuadTech, LLC (Norcross, Georgia). The Simplex/Duplex Telecontrollers allowed for both control of pump dosing time and interval, flow monitoring, as well as visual and audio alarms for low or high water levels. They also were designed as remote monitoring and dial-out, features that were not utilized here. A handheld terminal or serial port of a PC was used for setting the various parameters and testing floats and alarms. In addition, these pump controllers had the capability of dialing a remote computer for

Figure 4 Low-Pressure-Pipe Dosing System

historical database monitoring and set-point control, allowing for centralized management and monitoring.

After repeated failures due to lightning strikes and a general dissatisfaction with their overall performance and software, the QuadTech controllers were replaced with Orenco Systems Model MVP-SSF2 PTRO/PTRO control panels (Figure 5). These duplex control panels allowed for control of the two pumps required for each system, recirculation and leachfield dosing for the recirculating sand system, and peat filter dosing and leachfield dosing for the peat filter system. The systems were easy to program and provided monitoring of daily total pump events and "pump on" time.

Added features included standard motor contactors and individual circuit protection for each pump and the PLC controller. The option for up to four tank float switches provided flexibility in cases of either low or excess high flow rates or possible pump failures. Especially useful was the high-level override feature that activated the leachfield dosing pumps for a set time; this allowed the holding tanks to be pumped down in a controlled manner when there were excessive flows.

The two pumps used to split the flow between the systems were originally controlled by the QuadTech, LLC controllers. Both of these controllers were replaced with a simple repeat cycle timer (Omron H3CR) and motor relay constructed in-house (Figure 5). The repeat cycle timer allowed control of on and off periods between 0.05 seconds and 100 hours. This allowed uniform loading of both systems.

System Monitoring

Water quality analysis was divided into two components: real-time remote monitored data and traditional laboratory "wet chemistry" data. Table 1 on page 32 presents an itemized listing of the real-time monitored water quality parameters and the monitoring equipment selected. The various sensors and probes were located in the influent, effluent, and denitrification sumps in each system. This component of monitoring is further described in Ebeling and Tsukuda, 2002.

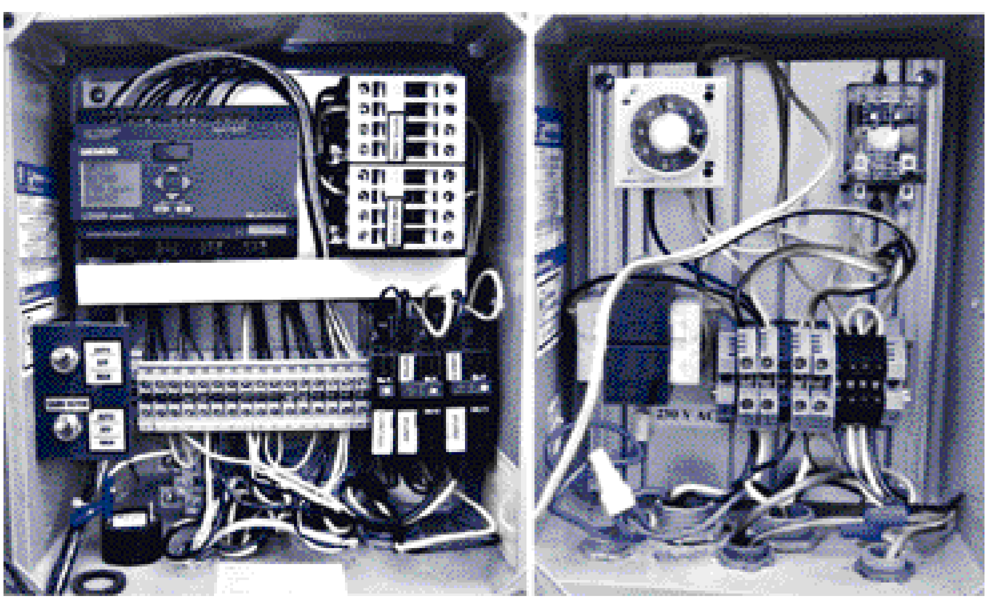


Figure 5 Orenco Systems Control Panel and Repeat Cycle Timer/Relay System

Table 2 lists the conventional "wet chemistry" water quality parameters monitored on a routine basis. Samples were obtained from the influent and effluent of each system; i.e., from sampling ports on the pump discharge lines used for dosing the filters or leachfield or by a grab sample from the denitrification-holding tank on the recirculating sand filter. Normally, samples were analyzed immediately or, if necessary, refrigerated and analyzed the next day. Most of the analyses were conducted using Hach Company water quality testing procedures that are either EPA-approved or accepted for reporting purposes, and all were based upon *Standard Methods* (APHA, 2000). All water quality analyses were done in the Freshwater Institute's onsite water quality lab following generally accepted laboratory standards.

In addition to performing water quality analysis, the flow meters recording discharge from each system, tank water levels, and overall appearance were checked daily. These observations provided early warning of flow interruptions caused by plugged water meters or pump failures.

Due to the extensive use of water conservation measures in the new facility, the daily flow rate of wastewater was significantly less than the expected design flows and at higher concentrations compared to "typical" published values. Additional wastewater flow to operate both systems at design flow rates was obtained by using the waste stream from an onsite recirculating aquaculture facility growing arctic charr. Two rotating microscreen filters are employed to remove suspended solids from the grow-out tank's water for two commercial size recirculating production systems. The backwash from these screen filters is then further concentrated in three, cone-bottomed settling tanks. The supernatant from these solids settling cones was within the typical range for septic tank effluent (Table 3), except for a lower ammonia level and a higher nitrogen loading due to the presence of nitrate-nitrogen and a high organic N concentration.

Table 1 Real-Time Monitored Water Quality Parameters.

Parameter	Instrumentation
pH, temperature	GLI Model P33 Analyzer & pH sensor, temp.
ORP, temperature	GLI Model P33 Analyzer & ORP sensor, temp.
Dissolved oxygen	Point Four Systems Inc., Oxyguard DO Probe
Sludge depth	SEPTICwatch monitor, Worldstone, Inc.
Dosing backpressure	Pressure sensor
Process flows	In-line water meter, pulse output
Pump on/off	DPDT Relay

Table 2 Conventional Laboratory Water Quality Parameters.

Water Quality Parameter	*Standard Methods* (APHA, 2000), Monitoring Method Used in Laboratory
C-BOD_5	5210 B. 5-Day BOD Test
Total Suspended Solids	2540 Solids
NH_3-N	4500 – NH_3 Nitrogen (Ammonia) Hach Method 8038
NO_3-N	4500-NO_3- Nitrogen (Nitrate) Hach Method 8171
Total N	4500-N C. Persulfate Method
Phosphorus	4500-P Phosphorus (Orthophosphate) Hach Method
Turbidity	2130 B. Nephelometric Method Hach Method 8195
Alkalinity	2320 – Titration Method
fecal coliform	9222 D. Fecal Coliform Membrane Filter Procedure Hach Method 8074 with m-Endo Broth
total coliform	9222 B. Standard Total Coliform Membrane Filter Procedure Hach Method 8074 m-FC with Rosolic Acid Broth

RESULTS AND DISCUSSION

When the systems were first placed in operation, difficulty was experienced in balancing the flow to both systems and programming the QuadTech controllers. In addition, due to the extensive use of water conservation measures, the daily flow rate of wastewater from the facility was significantly less than the expected design flows and with higher concentrations compared to "typical" published values. Thus, only the sand filter was initially brought on-line in the fall of 2000. With the addition of a full-time environmental research engineer, a summer intern, and additional flow from aquaculture wastewater treatment stream, the peat filter was brought on-line in the early summer of 2001.

Routine water quality monitoring and data acquisition began in the summer of 2001. The two systems were sampled on regular bases (every two weeks) and the remote monitoring system was fully operational.

Table 3

Effluent Wastewater Characteristics: Residential Septic Tanks and Aquaculture Wastewater Supernatant

Parameter	Residential septic tank effluent[1] Range	Typical	Aquaculture supernatant effluent[2]
BOD_5 (mg/L)	150-250	180	271
TSS (mg/L)	40-140	80	100
NH_3-N (mg/L)	30-50	40	8
Org N as N (mg/L)	20-40	28	61[3]
Total Nitrogen (mg/L)		68[3]	85
NO3-N (mg/L)	—	—	16
Orthophosphate (mg/L)	—	10[4]	12
Org P as P (mg/L)	4-8	6	8[4]
Total P as P (mg/L)	12-20	16	20
TKN[4] (mg/L)	50-90	68	53[5]
Alkalinity (mg/L as CaCO3)	—	—	258

1 Crites and Tchobanoglous, 1998
2 Sample date: 10/10/02 effluent supernatant from settling cones for waste discharge
3 Estimated from Total Nitrogen analysis as: org N = Total Nitrogen – ammonia – nitrate
4 Estimated from Orthophosphate analysis as: org P ≈ Total P - orthophosphate
5 Estimated from TKN = org N - ammonia

For the initial study period of six months, the average flow rates through the two systems were 150 gpd. For the recirculating sand filter, this was approximately 50 percent of the design flow rate of 300 gpd. For the peat filter, each module was rated at 150 gpd, and only two of the three peat filter modules were initially used to yield a 50 percent of design loading. At the end of six months, the flow was increased to the full design loading rates of 300 gpd. Tables 4 and 5 summarize the system performance for individual systems at these two flow rates, and Tables 6 and 7 summarize the overall systems performance.

RSF III Recirculating Sand Filter

System performance was determined by comparing the mean values of the effluent

Table 4

Performance of the Recirculating Sand Filter During the First 12 Months of Operation

Parameter	50% Design flow rate: No. of Samples	Influent	Effluent	% Removal	100% Design flow rate: No. of Samples	Influent	Effluent	% Removal
Q effluent			192 gpd				340 gpd	
Q denitrification		71 gpd				293 gpd		
Q recirculation		1,690 gpd				1,870 gpd		
TSS (mg/L)	13	58.4 (18)	11.7 (10)	80%	7	74.4 (50)	6.4 (3)	91%
BOD (mg/L)	6	153.9 (43)	10.3 (8)	93%	4	156.1 (79)	9.0 (7)	94%
NH_3-N (mg/L)	14	88.4 (16)	35.1 (26)	60%	14	41.7 (15)	9.1 (5)	78%
NO_3-N (mg/L)	16	4.0 (2)	10.2 (6)	{240%}	11	1.7 (2)	6.0 (5)	{350%}
TN (mg/L)	3	119 (33)	54.7 (21)	54%	11	61.5 (24)	27.4 (7)	67%
TP (mg/L)	7	9.9 (2.1)	5.7 (1.3)	26%	5	7.7 (1.5)	6.3 (1.4)	11%
Turbidity (FTU)	14	102 (58)	9.5 (12)		13	140 (38)	25.4 (20)	
pH	16	7.12 (0.21)	7.05 (0.16)		13	7.20 (0.11)	7.32 (0.12)	
Fecal Coliform (#/100mL)	10	558,000	5,670	99.0%	8	168,200	14,500	91.4%
Total Coliform (#/100mL)	10	1,135,000	40,400	96.4%	8	2,034,000	43,900	97.8%

Values are means of data and percent change, except for coliform which are geometric means
( ) denotes standard deviation
% removal based on concentration: ([Influent - Effluent] / Influent) * 100%, except percent removal { } increase.

to the influent concentrations. Overall the recirculating sand filter performed admirably (Table 6), reducing both TSS and BOD_5 to below secondary discharge standards (20/20), and obtaining overall mean removal efficiencies of 85 percent and 94 percent for TSS and BOD_5.

The wide variation in treatment performance (reflected in the large standard deviations) is in part due to operational problems and pump failures. For example, TSS removal efficiencies were routinely above 95 percent, with discharge concentrations below 10 mg/L for over two-thirds of the 20 samples taken. Of the 10 samples of BOD_5, six were below 10 mg/L and only one was above 20 mg/L. There was very little difference in performance at the two loading rates with only a slight improvement in TSS removal at the 100 percent design flow rate.

Nitrification across the sand filter also demonstrated wide variations, with average removal efficiencies for ammonia-nitrogen of 66 percent, but with a range of values from 13 percent to 97 percent. This wide range of values was probably due to system interruptions, which occurred frequently during the initial phase of operation and resulted in little or no recirculation across the sand bed. This is also reflected in the low flow rate removal of only 60 percent versus the high flow rate removal of 78 percent. The decrease in ammonia concentration for the second time period reflects the dilution that occurred due to the lower concentration of ammonia in the aquaculture wastewater.

One of the difficulties of a recirculating sand filter is maintaining the bacteria biomass in the bed in an active state. Interestingly, ambient air temperature appeared to have no significant effect on the nitrification reactions, with the best discharge values occurring during the winter quarter. This is probably due to the high recirculation rate maintaining the bed at the temperature of the incoming waste stream and the insulating properties of the soils surrounding the tanks.

Values of nitrate in the effluent also exhibited a wide variation, ranging from 0.2 mg/L to 15 mg/L. To some extent, this may be due to the use of aquaculture wastewater that contains varying concentrations of nitrate, depending upon the feeding rate and biofilter performance. Most important though is that over half of the measured effluent samples were at or less than 10 mg/L. Analysis of the rate of nitrate formation is further complicated by the denitrification process in the holding tank.

Denitrification, as measured by the reduction in TN, also exhibited a wide variability, ranging from a low of 12 percent to a high of 80 percent removal rates, with an average of 50 percent. No obvious conclusions can be reached concerning denitrification as a function of recycle rate with good removal efficiencies occurring at both a low (71 gpd) and a high (293 gpd) rate of recycle. Additional

Table 5 **Performance of the Peat Filter During the First 12 Months of Operation**

	50% Design flow rate				100% Design flow rate			
Parameter	No. of Samples	Influent	Effluent	% Removal	No. of Samples	Influent	Effluent	% Removal
Q effluent			154 gpd				336 gpd	
TSS (mg/L)	9	53.0 (13.3)	3.4 (4.3)	94%	6	57.6 (9.4)	8.8 (6.8)	85%
BOD (mg/L)	3	72.7 (10.7)	2.2 (0.2)	97%	3	80.9 (78)	1.6 (1.5)	96%
NH_3-N (mg/L)	11	90.0 (20)	12.4 (11)	86%	13	42.0 (15)	17.9 (10)	54%
NO_3-N (mg/L)	11	3.9 (3)	66.3 (59)	{2800%}	12	1.9 (2)	10.9 (11)	{590%}
TN (mg/L)	4	121 (28)	98.5 (31)	20%	8	64.0 (28)	43.0 (17)	33%
TP (mg/L)	7	8.6 (1.4)	6.6 (0.8)	22%	5	7.4 (1.5)	6.3 (1.1)	25%
Turbidity (FTU)	9	60.1 (32)	1.4 (1)		13	103.2 (41)	12.3 (9)	
pH	10	7.35 (0.21)	6.24 (0.33)		13	7.35 (0.11)	6.87 (0.13)	
Fecal Coliform (#/100mL)	7	114,000	210	99.8%	6	135,000	17,700	86.9%
Total Coliform (#/100mL)	8	588,000	9,400	98.4%	5	891,000	112,000	87.4%

Values are means of data and percent change, except for coliform which are geometric means
( ) denotes standard deviation
% removal based on concentration: ([Influent - Effluent]/ Influent) * 100%, percent removal { } increase

studies on the effect of recycle rate are currently under way, with recycle rates varying from zero to five times effluent discharge rates.

There are no obvious removal pathways for phosphorus in a recirculating sand filter except bacterial uptake. Overall total phosphorus removal decreased over the period of study from over 50 percent to a low of 2 percent, suggesting some form of adsorption or chemical uptake. This area is also under additional study by the authors.

Turbidity is not an often measured parameter for septic system wastewater, but it is a relatively simple and straight forward measurement. It also reflected very nicely the overall performance of the system, with higher values during periods of system difficulties and very low values during optimum performance periods.

There was only a minor change in pH across the sand filter, with a slight decrease at 50 percent design flow and a slight increase at the design flow rate. Since nitrification tends to decrease pH (consumption of alkalinity) and denitrification increases pH (production of alkalinity), this could be seen as a competition between the two processes with nitrification winning at the low flow rates and denitrification winning at the higher flow rates. The data shows a slight decrease in pH across the sand filter during the first six months of operation, with a minor increase in pH during the second six months.

Fecal and total coliform removal efficiencies for the recirculating sand filter were mixed. During the first period of low flow operation, removal rates for fecal and total coliform from 99.0 percent and 96.4 percent were observed (with discharge levels for several months for fecal coliform of less than 1,000 CFU/100 mL). During the design flow rate period, performance was not as high for fecal coliform removal (91.4 percent), but total coliform removal was similar to the low flow rate (97.8 percent).

In reviewing the data, it should be noted that even with several recirculation flow interruptions of extended duration and other daily operational problems, the recirculating sand filter effluent still easily met minimum discharge requirements for secondary waste discharge. More importantly, the denitrification component was able to reduce the total nitrogen discharge by 58 percent, reducing the impact nitrogen on the environment.

One significant advantage of the overall design of the RSF III recirculating sand filter is that it allows it to be self-contained in two 1,000-gallon septic tanks. An important disadvantage with this system configuration is that the overall systems' effluent is a mixture of sand filter effluent and septic tank effluent, which has traversed the bottom zone. This configuration defeats the purpose of investing in the high quality treatment capabilities of a recirculating sand filter system by mixing the two waste streams in the bottom zone.

Table 6 Summary of Sand Filter Performance (6/01 to 7/02)

Parameter	No. of Samples	Influent	Effluent	% Removal
Q effluent			192 and 340 gpd	
Q dentrification		71 and 293 gpd		
Q recirculation		1690 and 1870 gpd		
TSS (mg/L)	20	64.0 (33)	9.9 (9)	85%
BOD (mg/L)	10	154.8 (55)	9.8 (7)	94%
NH3 (mg/L)	28	65.0 (28)	22.1 (23)	66%
NO3 (mg/L)	29	2.9 (2)	8.2 (6)	{280%}
TN (mg/L)	14	67.1 (30)	27.9 (18)	58%
TP (mg/L)	14	8.8 (2.1)	6.0 (1.3)	32%
Turbidity (FTU)	27	122.6 (51.6)	15.6 (15)	
pH	20	7.15 (0.17)	7.17 (0.20)	
Fecal Coliform (#/100mL)	18	327,400	8,601	97.4%
Total Coliform (#/100mL)	18	1,471,000	41,900	97.2%

Values are means of data and percent change, except for coliform which are geometric means
( ) denotes standard deviation
% removal based on concentration: ([Influent - Effluent] / Influent) * 100%, percent removal { } increase

Peat Filter

Overall, the peat filter outperformed the recirculating sand filter in reducing both TSS and BOD_5 to below secondary discharge standards by a wide margin, with average TSS values of less than 6 mg/L and BOD_5 values averaging around 2 mg/L. These correspond to removal efficiencies of 89 percent for TSS and 97 percent for BOD_5. The wide variation in treatment performance (reflected in the large standard deviations) is in part due to operational problems and pump failures and flooding of the peat bed due to clogged drainage holes when the flow rate was increased to 100 percent of design flow. Yet, even with the peat filter totally flooded, TSS values were still below secondary standards (8.8 mg/L) and BOD_5 values were unaffected.

Nitrification across the peat filter also demonstrated wide variations, with average removal efficiencies for ammonia-nitrogen measuring 86 percent during the 50 percent design flow, but dropping off significantly during the flooded conditions of the 100 percent design flow period, from a high of 77 percent initially to a low of 30 percent at the end. The nitrification bounced back to over 94 percent once the filter was repaired and normal flow resumed.

Values of nitrate in the effluent also showed a sudden and pronounced changed when the flow

Table 7 Summary of Peat Filter Performance (6/01 to 7/02)

Parameter	No. of Samples	Influent	Effluent	% Removal
Q effluent			154 and 336 gpd	
TSS (mg/L)	16	54.9 (11)	5.9 (6)	89%
BOD (mg/L)	6	76.9 (50)	2.2 (0.5)	97%
NH3 (mg/L)	24	62.4 (29)	15.2 (10)	76%
NO3 (mg/L)	20	3.1 (2.7)	30.1 (28)	{990%}
TN (mg/L)	12	83.0 (39)	61.5 (34)	26%
TP (mg/L)	12	8.3 (1.2)	6.6 (0.8)	20%
Turbidity (FTU)	22	83.5 (45)	7.5 (9)	
pH	20	7.35 (0.16)	6.57 (0.44)	
Fecal Coliform (#/100mL)	13	123,000	1,600	98.7%
Total Coliform (#/100mL)	14	685,000	32,500	95.3%

Values are means of data and percent change, except for coliform which are geometric means
( ) denotes standard deviation
% removal based on concentration: ([Influent - Effluent] / Influent) * 100%, percent removal { } increase

was increased, dropping from an average effluent concentration of 68 mg/L to 2.3 mg/L. This was the first indicator that something was amiss with the peat filters, since there was, at first, no obvious sign of flooding. It was only later, in the middle of the first quarter, that signs of flooding and standing water were observed in the filters. Once the drainage problem was corrected, the nitrate values returned to their previous levels, as did nitrification.

The peat filters did not at this time have any recirculation of effluent back to the holding tank, so very little denitrification was expected. Still, a reduction in total nitrogen was observed during the entire year, averaging about 28 percent overall removal rate. Interestingly, the highest rates occurred when the peat filter was flooded.

Because of the wide variety of microfauna growing in the peat filters and the chemical, physical, and biological mechanisms that exist, significant removal of phosphorus was expected. This was not observed in this system with average removal rate of phosphorus of only 20 percent, which remained fairly constant over the year long study.

As previously mentioned, turbidity is not an often measured parameter for septic system wastewater. But in this case it reflected very nicely the overall performance of the system, with higher values during periods of system difficulties and very low values during optimum performance periods.

As was expected with the peat filters, the pH dropped across the beds, although not significantly enough to impact discharge to the environment.

Similar to the sand filter, the fecal and total coliform removal efficiencies for the peat filter were mixed. During the first six months of operation, removal for fecal and total coliform of 99.8 percent and 98.4 percent were observed with discharge levels for several months of less than 1,000 CFU/100 mL. During the first quarter of 2002, the peat filter drain lines clogged, the peat filter flooded, and the system performance never recovered with removal of only 86.39 percent and 87.4 percent for fecal and total coliform.

Low-Pressure-Pipe (LPP) Dosing Leachfield

Both of the LPP dosing systems worked very well during the study period. Visual observations showed no biomat formation in the absorption trenches. Several pieziometers were installed immediate adjacent to the trench and at the midpoint between the two trenches. No standing water or moisture was observed in either trench, suggesting that all of the water percolated directly downward.

Operation and Maintenance

Operation and maintenance is a crucial part of any successful onsite wastewater treatment system. The experience gained during this demonstration project emphasized the need for continued operation and maintenance of alternative systems with the need for regular, periodic inspection to insure proper system operation. Several of the operation and maintenance problems have already been described. In general, most of the problems with the two systems were self-generated due to poor layout, installation, and landscaping decisions.

Overall both systems worked extremely well. One of the major problems with the flow meters and in some cases the pumps, were plugging due to wood chips. The flow meters were normally designed for domestic water supply monitoring and were easily plugged by small particles. The area around the two systems had been landscaped with wood chips to demonstrate the size and overall layout. In retrospect, this was a terrible idea, in that the wood chips found their way into the sumps and caused repeated problems with the flow meters and sump pumps.

Part of the problem may have been the level of activity and daily access to the sumps for monitoring flows and overall system performance. Obviously this would not occur under standard operating conditions. It was only late in the project that inline filters with easily removable stainless steel cartridge filters were installed that virtually eliminated the problem with the flow meters.

In terms of the mechanical systems, both filters had problems, due to clogging of the water meters, and pump failures, due to clogging by wood chips and other debris in the pump sump. During installation, the pumps were not elevated off the bottom of the pump sump as is routinely done to minimize clogging by sediment and debris. In addition, there was very little room for the plumbing and the two pumps, which made routine maintenance and the removal of the pumps for repair very difficult. In contrast, the peat filter mechanical systems worked very well, with minimal interruptions.

Over the course of the study, lightning strikes damaged the QuadTech, LLC's control systems on two occasions. After the second failure, they were replaced with Orenco control systems, and were undamaged after a third lightning strike that severely damaged the real-time monitoring system. Power surges, spikes, and lightning strikes need to be taken into consideration when specifying monitoring and control systems for outdoor systems.

CONCLUSION

The effectiveness of the two systems was demonstrated by their ability to remove pollutants from the wastewater, including BOD_5, TSS, fecal coliform bacteria, and nutrients (N and P). Both systems produced an effluent with the following average characteristics: Sand Filter—9.8 mg/L BOD_5, 9.9 mg/L TSS, 22.1 mg/L NH_4-N, 8.2 mg/L NO_3-N, 27.9 mg/L TN-N, 6.0 mg/L TP-P, and 8,600/100 mL fecal coliforms. Peat Filter—2.2 mg/L BOD_5, 5.9 mg/L TSS, 15.2 mg/L NH_4-N, 30.1 mg/L NO_3-N, 61.5 mg/L TN-N, 6.6 mg/L TP-P, and 1,600/100 mL fecal coliforms.

Both systems were hydraulically loaded at two levels (50 percent and 100 percent design rate) and at the highest loading, the peat filter hydraulically failed. Due to a series of operational problems, both systems showed a wide variation in effluent characteristics. The recirculating sand filter was moderately effective in removing nitrogen with an average 58 percent removal rate over the monitored period, while the peat filter—with no recirculation—only removed on average 26 percent of the nitrogen. The monitoring of the two systems will be continued under different loading scenarios, and operating conditions, with and without recirculation.

ACKNOWLEDGEMENTS

The authors wish to thank the following interns from Shepherd College for their long hours spent in the water chemistry lab: Matt Mullenax, Lauren Gleason, Sarah Ogden, and Nicole Vernon.

REFERENCES

APHA. 1989. *Standard methods for the examination of water and wastewater.* 17th ed. American Public Health Association, American Water Works Association, Water Pollution and Control Federation, Washington, D.C.

Crites, R. and G. Tchobanoglous. 1998. *Small and decentralized wastewater management systems.* WCB/McGraw-Hill, 1084 pp.

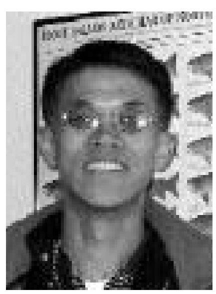
Ebeling, J. M., and S. Tsukuda. 2002. Real-time monitoring of a recirculating sand and peat filter in West Virginia. (In preparation).

Kozar, M. D., W. A. Hobba, Jr. and J. A. Macy. 1991. *Geohydrology, water availability and water quality of Jefferson County, West Virginia.* U.S. Geological Survey, WRIR 90-4118, 93 pp.

Piluk, R. J. and B. R. Byers. 2000. Small recirculating filters for nitrogen reduction. Presented at the Small Drinking Water and Wastewater Systems Conference, January 12-15, 2000, Phoenix, AZ.

Puraflo. 2000. Treatment mechanisms. http://www.bnm-us.com/index.html.

James M. Ebeling, Ph.D., is an Environmental Engineer with the Conservation Fund Freshwater Institute in Shepherdstown, West Virginia. Ebeling recently received his doctorate in Biological Resources Engineering from the University of Maryland, College Park. His areas of research include aquaculture, wastewater treatment and systems monitoring and control.



Scott M. Tsukuda is Director of Operations with the Conservation Fund Freshwater Institute in Shepherdstown, West Virginia. His current research areas of interest include networking, and process monitoring and control. Past work has included evaluation of biofilter performance and solids removal for aquaculture systems.

Joseph Andrew Hankins is the program director for the Conservation Fund Freshwater Institute in Shepherdstown, West Virginia. He earned a bachelors' degree in general science from Purdue University in 1979 and a masters' in environmental biology from Hood College in 1992. Hankins' project experience has included work in aquaculture, rural economic development, constructed wetland treatment systems, community and onsite wastewater engineering, and acid mine drainage treatment and is active in groups focused on the strategic importance of water, water quality standards, and community water infrastructure planning.

Clement Solomon is a program coordinator for the National Onsite Demonstration Program (NODP) at the National Environmental Services Center located at West Virginia University, where he directs the onsite/decentralized wastewater technology initiatives. He specializes in assisting local leaders, community officials and the public understand, develop and implement effective technological solutions in dealing with their wastewater issues and needs. Currently, he directs NODP Phase V, which addresses wastewater problems in the Appalachian region with low income and rural communities.

Effluent Filters

NSFC ENGINEERING SCIENTIST
Andrew Lake

I am having an onsite wastewater treatment system installed, and my installer said that I need an effluent filter. What is an effluent filter and what is it supposed to do for my system?

Editor's Note: This column is based on calls received over the National Small Flows Clearinghouse (NSFC) technical assistance hotline. If you have further questions concerning septic tank effluent filters, call (800) 624-8301 or (304) 293-4191 and ask to speak with a technical assistant.

The proper management and maintenance of onsite systems is vital to system longevity. An important part of septic tank maintenance is preventing suspended solids from entering the soil absorption system or drainfield. Of course, there are many other factors that may extend the life of an onsite system, but using a septic tank effluent filter is a means of reducing solids from reaching the drainfield.

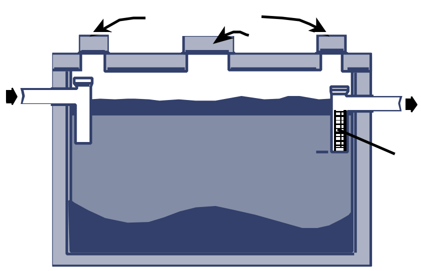


Figure 1 Typical single compartment septic tank with effluent filter installed in the outlet tee.

Source: National Small Flows Clearinghouse poster Item # WWPSPE02 Onsite Wastewater Treatment for Small Communities and Rural Areas.

Generally, the first component of a conventional onsite wastewater treatment system is the septic tank. Septic tanks can be either single- or multi-compartment tanks (see Figure 1) made of steel, plastic, or concrete, each having an inlet and outlet, inlet and outlet tees or baffles, and at least one manhole for access to the tank.

The septic tank acts as a collection and treatment component for a conventional onsite system, where both liquid and solid wastes from the household are received. Within the tank, most solids will settle to the bottom, creating what is commonly called sludge. Other waste, such as fats, oils, and grease, float to the top creating what is known as the scum layer. The liquid between these two layers is the wastewater effluent that is passed to the disposal area.

The effluent is generally clear but contains suspended solids, such as food particles, or other small solid particles that won't settle to the bottom and are not part of the scum layer. The suspended solids will eventually pass through the outlet to the onsite disposal area. In a conventional onsite wastewater treatment system, the disposal area is referred to as the drainfield or leachfield. The wastewater effluent is conveyed to the drainfield by one of two methods, by gravity or by pumping.

Even though the effluent normally contains suspended solids, in most cases, these particles do not have immediate effects on the drainfield. However, over time, these solids can build up and clog the pore spaces in the disposal area. The solids carryover does not necessarily mean that an onsite system disposal area will fail, just that over time, accumulation of solids will occur and effectively reduce percolation rates.

One method to decrease the amount of suspended solids and subsequently reduce the organic content of the waste stream, measured as the biological oxygen demand (BOD_5), and thus increase the longevity of the onsite wastewater treatment system, is to install a septic tank effluent filter. Another advantage is that effluent filters are cost-effective, and in some instances, reusable.

Effluent filters come in a variety of shapes and sizes, and are produced by several different manufacturers and have a range of applications from individual homes to commercial sites. The basic principle of the effluent filter is to provide additional surface area for suspended solids to collect and attach, before they pass to the drainfield. Each filter is unique in its individual design, but similar in purpose; that is, to decrease the amount of solids carryover to the drainfield and by doing so reduce BOD_5.

Independent research performed at Tennessee Technological University (Treanor, 1995) suggests that effluent filters do indeed reduce suspended solids as well as BOD_5 in onsite systems. The study was performed as research for a master's thesis, and was conducted at eight unrelated locations, under different loading rates and uses. The study was performed using three different effluent filters. The statistical analysis showed that the filters significantly reduced the BOD and suspended solids in septic tank effluents.

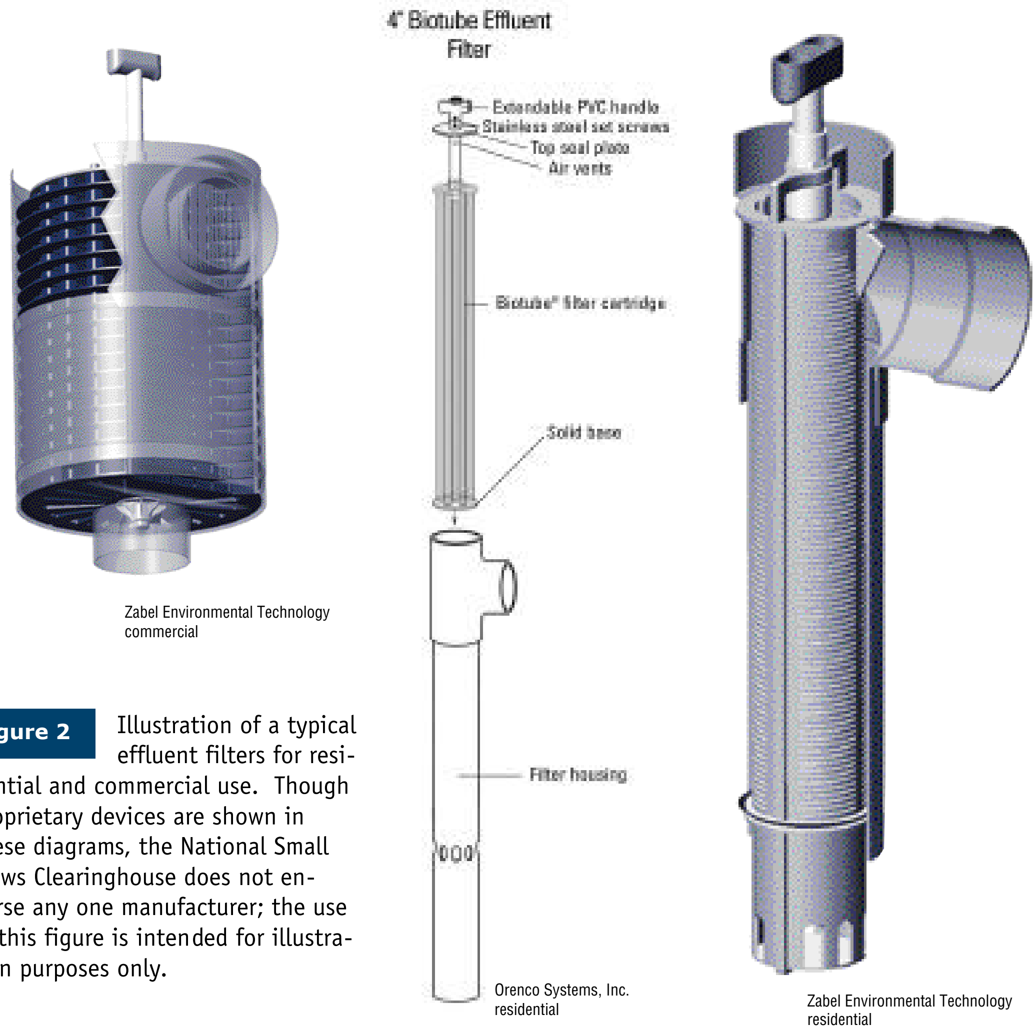


Figure 2 Illustration of a typical effluent filters for residential and commercial use. Though proprietary devices are shown in these diagrams, the National Small Flows Clearinghouse does not endorse any one manufacturer; the use of this figure is intended for illustration purposes only.

Although other research is being performed, there is still some debate on the overall effectiveness of septic tank effluent filters.

The effluent filter, as mentioned earlier, is placed in the outlet of the septic tank. These filters can be installed in old septic tanks, replacing the outlet baffle or tee, or during installation of new tanks. It is important that you contact your local regulatory agency to determine if the use of an effluent filter is required or recommended for your onsite wastewater treatment system. Some states require the use of effluent filters while others simply recommend their usage, yet other states have formed no real opinion about effluent filters.

As noted, effluent filters are capable of reducing suspended solids and as a result, reduce BOD and increase the longevity of onsite wastewater treatment systems. This, however, does not mean that the onsite system and the effluent filter itself do not require proper maintenance. It will still be necessary to have your septic tank pumped and regularly inspected.

The effluent filter also requires regular maintenance and must be periodically checked. As a concern for the homeowner's safety in dealing with the components of a septic system, most manufacturers and regulatory agencies recommend that a certified inspector or septic tank pumper provide this maintenance. The filter must periodically be removed from the tank, and the solids, which have been trapped and attached to the filter, must be washed back into the septic tank. This is why it would be more appropriate to have this done during the time your septic tank is being pumped. This perhaps is the one disadvantage of having an effluent filter. If the filter is not maintained, it will potentially clog and create problems for the onsite wastewater treatment system. Such an example could be plugging the septic tank, causing the sewage to back up into the home.

The National Small Flows Clearinghouse can provide additional information on septic tank effluent filters and resources regarding their usage. You may contact the National Small Flows Clearinghouse and request a Manufacturers/Consultants Database search for a list of septic tank effluent filter manufacturers. This information can also be obtained on the National Small Flows Clearinghouse Web Site at: **www.nsfc.wvu.edu**

Treanor, William O. 1995. *Treatment capability of three filters for septic tank effluent.* Tennesee Technological University, Tennessee.

NSFC Products
Are Available

The National Small Flows Clearinghouse (NSFC) offers more than 380 educational products about onsite wastewater treatment. The following are a few of the products that relate to the feature articles in this issue. Please note that shipping charges apply to all orders, even if the product itself is free.

2002-2003 National Decentralized Water Resources Capacity Development Project: Training, Research and Development Plan

National Decentralized Water Resources Capacity Development Project

The National Decentralized Water Resources Capacity Development Project (NDWRCDP) coordinates and implements national training, research, and development in decentralized water resources. The plan presented in this 19-page booklet describes currently funded projects and long-term plans for decentralized wastewater management.

This booklet is free. Request Item #WW-BLMG17.

Application of a Risk-Based Approach to Community Wastewater Management: Tisbury, Massachusetts

National Decentralized Water Resources Capacity Development Project

Tisbury, Massachusetts, situated south of Cape Cod on the island of Martha's Vineyard, provides an example of decentralized wastewater management in a coastal island community with nutrient-sensitive resources, a sole-source aquifer, and population growth concerns. Tisbury's management program provides a case history that other communities can adapt to their own circumstances. This 110-page overview of the management program includes decision-making points, barriers to implementation, status of the implementation effort, and next steps.

This book is free. Request Item #WW-BKCS24.

Decentralized Systems Technology Fact Sheet: Low-Pressure Pipe Systems

Office of Water

Less than one-third of the land area in the U.S. has soil conditions suitable for conventional soil absorption systems. Although not an alternative for all unsuitable soils, the low-pressure pipe (LPP) system has proven to be useful to some specific conditions where conventional systems frequently fail. This seven-page fact sheet describes the LPP system, its main components, applicability, advantages and disadvantages, design criteria (including soil, space, drainage, and topography requirements), performance, operation and maintenance, and costs. The LPP system is illustrated, and a general maintenance schedule is included. References and resources for additional information are listed. This information may be useful to engineers, researchers, state regulatory agencies, local officials, general public, public health officials, and contractors/developers.

The cost for this fact sheet is $1.40. Request Item # WWFSGN209.

On-Site Wastewater Treatment Systems: Operation and Maintenance

Texas A&M University

Once viewed as a temporary way to manage wastewater for homes prior to connecting to a centralized sewer system, onsite systems are now considered a permanent solution for treatment wastewater. With approximately 37 percent of homes being built using an onsite wastewater treatment system, it is vital that residents maintain them regularly to prevent health hazards or environmental pollution. This brief and easy-to-read four-page fact sheet describes how these systems work, including the conventional septic system, and what factors affect them. The fact sheet discusses maintenance, management, and water conservation. Two full-color illustrations depict the septic tank and soil absorption field system. Researchers, state regulatory agencies, local officials, the general public, operators, and contractors/developers may find this information useful.

The cost for this fact sheet is $1.00. Request Item #WWFSOM45 (English Version) or Item #WWFSOM46 (Spanish Version).

On-Site Wastewater Treatment Systems: Tablet Chlorination

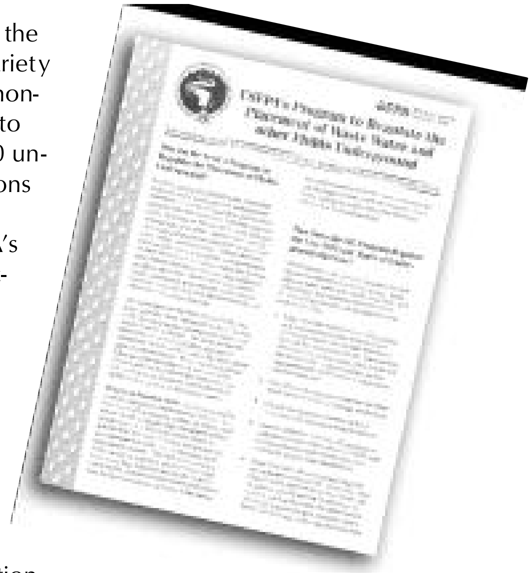
Texas A&M University

If wastewater is sprayed onto lawns, it must first be disinfected to prevent odors and remove disease-causing microorganisms. For onsite wastewater treatment systems, the most common form of disinfection is tablet chlorination. This four-page fact sheet discusses the components of tablet chlorinators, how the tablets disinfect water, and the proper uses of them for best performance. The fact sheet includes tips on chlorinator maintenance and a full-color drawing of the tablet chlorination system. Wastewater professionals who either recommend or install onsite wastewater treatment systems may find this information useful, as well as homeowners who may need to install a tablet chlorinator.

The cost for this fact sheet is $1.00. Request Item #WWFSGN206 (English Version) or Item #WWFSGN207 (Spanish Version).

USEPA's Program to Regulate the Placement of Waste Water and other Fluids Underground

U.S. Environmental Protection Agency


USEPA's Program to Regulate the Placement of Waste Water and other Fluids Underground

Facilities across the U.S. discharge a variety of hazardous and non-hazardous fluids into more than 400,000 underground formations known as injection wells. The U.S. EPA's Underground Injection Control (UIC) Program provides safeguards so that injection wells do not endanger underground sources of drinking water. This two-page fact sheet defines injection wells and discusses the five classes of injection wells. The need for the UIC program and how it works to protect groundwater supplies are also explained. This information may be useful to wastewater professionals whose job is to protect the public health by proper installation, operation, and/or regulation of injection wells (engineers, researchers, state regulatory agencies, local officials, planners, managers, state officials, public health officials).

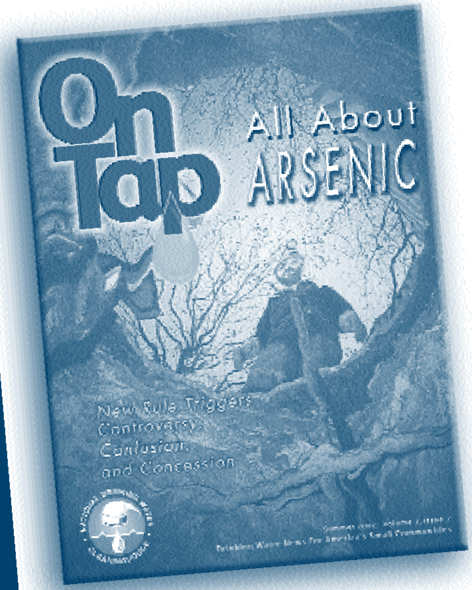
This fact sheet is free. Request Item #GNFS-RG67.

On-Site Wastewater Treatment Systems: Trickling Filter

Texas A&M University

A trickling filter is a bed of gravel media over which pretreated wastewater is sprayed. Microorganisms attach themselves to the media and form a biological film over it. As the wastewater trickles through the media, the microorganisms consume and remove contaminants from the water. This four-page fact sheet describes the trickling filter's components, how it treats wastewater, its design, and how to keep it working. Two full-color illustrations depict the trickling filter system. Wastewater professionals who recommend or install onsite systems, as well as homeowners, may find this information useful.

The cost for this fact sheet is $1.00. Request Item #WWFSGN208.



NDWC Offers Arsenic Treatment Information

Arsenic has long been identified as being toxic, and in drinking water it is associated with cancers and numerous other disorders. The National Drinking Water Clearinghouse offers several publications about removing arsenic from drinking water:

* *Using DWSRF Funds to Comply with the New Arsenic Rule*, item #DWFSFN32
* *Laboratory Study on the Oxidation of Arsenic III to Arsenic V*, item #DWBKRE21
* *Treatment of Arsenic Residuals from Drinking Water Removal Processes*, item #DW-BKOM18
* *Arsenic Removal from Drinking Water by Ion Exchange and Activated Alumina Plants*, item #DWBKOM12
* *Oxidation of Arsenic (III) by Aeration and Storage*, item #DWBLOM13
* *Arsenic Removal from Drinking Water by Coagulation/Filtration and Lime Softening Plants*, item #DWBKOM17
* *Regulations on the Disposal of Arsenic Residuals from Drinking Water Treatment Plants*, item #DWBLRG58
* *Arsenic Removal from Drinking Water by Iron Removal Plants*, item #DWBKOM14.

Order any of these publications by calling (800) 624-8301 or e-mailing ndwc_orders@mail.nesc.wvu.edu.

Free Newsletter Discusses Aspects of Onsite Systems

Homeowners, local officials, and others who want to learn about the financial side of onsite system management will appreciate the newsletter *Pipeline*, a National Small Flows Clearinghouse (NSFC) publication.

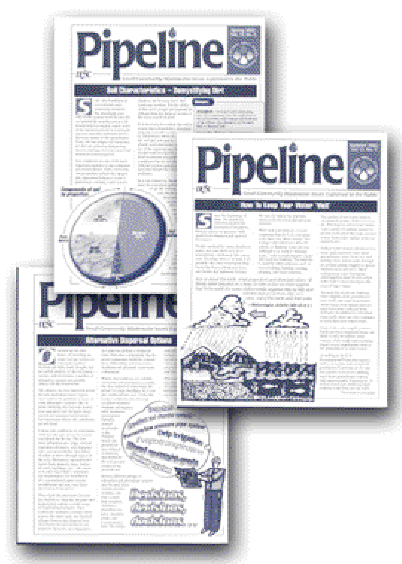
Pipeline is written for a general audience, and each issue explains a wastewater technology or theme of interest to local officials and and community residents. The articles are presented in an easy-to-read, nontechnical style and include a list of contacts and resources in each issue

Pipeline Spring 2002 is titled "Soil Characteristics: Demystifying Dirt" and reviews the characteristics of soil that affect the efficiency of, or choice of, dispersal methods. A glossary of soil-related terms is included. A case study is presented detailing an Indiana neighborhood where improper drainfields were installed, and now are failing, due to improper soil evaluation. This issue also provides a complete listing of past issues and topics of the *Pipeline* newsletter.

The Summer 2002 issue of *Pipeline* is titled "How To Keep Your Water Well" and presents the possible effects and special considerations that are mandatory to prevent the contamination of drinking water wells in areas where onsite treatment is employed. Included are tips from the EPA on protecting groundwater supplies and signs that suggest you should test your well.

The Fall 2002 issue is titled "Alternative Dispersal Options" and provides clear descriptions and diagrams of the various approved subsurface dispersal methods, including trenches, contour systems, drip irrigation, gravelless and chamber systems, mound systems, evapotranspiration systems, and pressure/low pressure pipe systems. A case study is presented which demonstrates the process for determining the most appropriate wastewater technology for a rocky, mountaintop observatory in California.

The *Pipeline* newsletter may be downloaded from NSFC's Web site. Located at **www.nsfc.wvu.edu**, the NSFC Web site also contains information about new wastewater-related products, NSFC services, and a calendar of upcoming conferences and events.



Readers are encouraged to reprint *Pipeline* articles in local newspapers or include them in flyers, newsletters, or educational presentations. Pipeline can also be ordered in bulk and distributed at public meetings or other forums.

To order a particular *Pipeline* issue or for a free subscription, call the NSFC at (800) 624-8301 or (304) 293-4191, or write to NSFC, West Virginia University, P.O. Box 6064, Morgantown, WV 26506-6064. The international subscription fee is $6. All back issues of *Pipeline* cost 20 cents per copy, and shipping charges do apply.

Products List

Item Number Breakdown

First two characters of item number: (Major Product Category)

WW Wastewater
FM Finance and Mangement
GN General Information
SF Small Flows
DP Demonstration Program

Second two characters of item number: (Document Type)

BK Book, greater than 50 pages
BL Booklet, less than 50 pages
BR Brochure
CD Computer Disk/ROM
FS Fact Sheet
PC Customized Search
PL Pipeline
PK Packet
PS Poster
QU Quarterly
SW Software
VT Video Tape

Third two characters of item number: (Content Type)

CM Computer search
CS Case Study
DM Design
FN Finance
GN General Information
IN Index
MG Management
NL Newsletter
OM Operation and Maintenance
PE Public Education
PP Public-Private Partnerships (P3)
RE Research
RG Regulations
TR Training

Last two characters of item number: Uniquely identifies product within major category

☐ Highlighted products are new

* Indicates changes in title, item number, and/or price

▲ First copy provided at no cost.

To place an order...

To place an order, call the National Small Flows Clearinghouse (NSFC) at (800) 624-8301 or (304) 293-4191, or use the order form on page 49 and fax your request to (304) 293-3161. You also may send e-mail to **nsfc_orders@mail.nesc.wvu.edu.** Be prepared to give the item number and title of the product you wish to order. Shipping charges apply to all orders.

The NSFC's *Products Catalog* provides abstracts of many products. The guide may be downloaded via the NSFC's Web site at **www.nsfc.wvu.edu**.

Case Studies

WWBLCS04	Crystal Lakes Wastewater Managemetn System: Private Wastewater Management System for a Large Subdivision (Crystal Lakes, Colorado)	$2.80
WWBLCS13	Minimum Grade Effluent Sewers (Dexter, Oregon)	$2.00
WWBLCS14	Free Access Intermittent Sand Filter (New York)	$3.40
WWBLCS18	Septic Tank Effluent Collection and Sand Filter Treatment (New York)	$3.00
WWBLCS21	Pollution Prevention at POTWs	$0.00
WWBKCS22	Combined Sewer Overflows and the Multimetric Evaluation of Their Biological Effects: Case Studies in Ohio and New York	$0.00
GNBKCS23	Top 10 Watershed Lessons Learned	$0.00
WWCDCS24	Application of a Risk-Based Approach to Community Wastewater Management: Tisbury, Massachusetts	$0.00

Computer Searches

You can search our Bibliographic or Manufacturers and Consultants Databases online by logging onto www.nesc.wvu.edu/nsfc/nsfc_databases.htm . If you do not have Internet access, please call the NSFC at the phone numbers below.

WWPCCM12	Bibliographic Database Search	Varies
WWPCCM15	Facilities Database Search *(database not available online)*	Varies
WWPCCM16	Manufacturers and Consultants Database Search	Varies

Computer Software

WWSWDM39	AIRVAC Version 3.2 and User's Guide	$7.60
WWSWDM55	STATION Version 3.0 and User's Guide	$7.10
WWSWDM77	Gravity Sewer Design Version 3.1M and User's Guide	$6.70
WWSWDM79	Variable Grade Effluent Sewers Version 2.2M and User's Guide	$10.15
WWSWDM91	User's Guide Spreadsheet PREGRAV.XLS, Version 1.2E	$6.50
WWSWDM92	User's Guide Spreadsheet PREGRAV.WQ1, Version 1.3	$6.20

Design

WWBLDM01	Subsurface Soil Absorption of Wastewater: Artificially Drained Systems	$5.10
WWBLDM03	Onsite Wastewater Disposal: Distribution Networks for Subsurface Soil Absorption Systems	$13.80
WWBLDM04	Onsite Wastewater Disposal: Evapotranspiration and Evapotranspiration/Absorption Systems	$4.80
WWBLDM08	Management Plans and Implementation Issues: Small Alternative Wastewater Systems Workshops	$6.30
WWBKDM09	Wisconsin Mound Soil Absorption System Siting, Design, and Construction Manual and Pressure Distribution Networks	$15.90
WWBLDM12	Site Evaluation for Onsite Treatment and Disposal Systems	$11.70
WWBLDM13	Design Module for Small-Diameter, Variable-Grade, Gravity Sewers	$13.80
WWBLDM14	Subsurface Soil Absorption of Wastewater: Trenches and Beds	$7.50
WWBLDM16	Subsurface Soil Absorption System Design Work Session: New Development—Stump Creek Subdivision	$6.85
WWBLDM18	Onsite Wastewater Treatment: Septic Tanks	$4.50
WWBKDM31	Planning Wastewater Management Facilities for Small Communities	$47.10
WWBKDM34	Land Application of Municipal Sludge	$0.00
WWBKDM35	Onsite Wastewater Treatment and Disposal Systems	$123.00

WWBKDM38 Constructed Wetlands and Aquatic Plant Systems for Municipal Wastewater Treatment............................$26.10
WWBKDM42 Dewatering Municipal Wastewater Sludges $0.00
WWBKDM46 Retrofitting POTWs..$0.00
WWBKDM47 Fine Pore Aeration Systems...$0.00
WWBKDM53 Alternative Wastewater Collection Systems $64.50
WWBLDM65 General Design, Construction and Operation Guidelines: Constructed Wetlands Wastewater Treatment Systems for Small Users Including Individual Residences, Second Edition..$14.10
WWBKDM67 Sewer System Infrastructure Analysis and Rehabilitation...$29.10
WWBKDM68 Technical Support Document for Water Quality-Based Toxics Control $0.00
WWBKDM70 Wastewater Treatment and Disposal Systems for Small Communities..$34.80
WWBKDM72 Guidelines for Water Reuse $0.00
WWBKDM75 Combined Sewer Overflow Control................................$0.00
WWBLDM76 Mound Systems: Pressure Distribution of Wastewater Design and Construction in Ohio...................................$4.40
WWBKDM78 Nitrogen Control..$96.30
WWBKDM82 Land Application of Sewage Sludge and Domestic Septage $92.10
WWBLDM87 Recirculating Sand/Gravel Filters for On-Site Treatment of Domestic Wastes $6.90
WWBLDM88 Single Pass Sand Filters for On-site Treatment of Domestic Wastes...$6.00
WWPKDM89 Producing Watertight Concrete Septic Tanks (video); and Septic Tank Manufacturing Best Practices Manual (booklet)..$62.60
WWBLDM90 Onsite Sewage Treatment and Disposal Using Sand Filter Treatment Systems: Guidelines and Specifications....$11.70

Handbook of Constructed Wetlands: A Guide to Creating Wetlands in the Mid-Atlantic Region . . .

WWBKDM83 Volume 1: General Considerations.................$16.50
WWBLDM84 Volume 2: Domestic Wastewater Operations ..$9.00
WWBLDM85 Volume 3: Agricultural Wastewater $9.60
WWBLDM86 Volume 5: Stormwater.......................................$11.40

Constructed Wetlands in East Texas Design, Permitting, Construction & Operations . . .

WWBLDM93 Volume 1: Single-Family Systems—Flows up to 500 GPD $9.80
WWBLDM94 Volume 2: On-Site Collection Systems—Flows from 500 to 5,000 GPD $9.80
WWBLDM95 Volume 3: Municipal Systems—Flows from 5,000 to 50,000GPD...$9.80
WWBLDM96 Volume 4: Plant Identification Guide.............$11.40
WWPKDM97 Effluent Pumps for Onsite Wastewater Treatment: Selecting the Right Pump for the Job............................$45.00
WWBKDM98 Constructed Wetlands Treatment of Municipal Wastewaters...$0.00

Fact Sheets

WWFSGN84 Constructed Wetlands/Natural Wetlands *(EPA)* $0.40
WWPKGN86 Nonpoint Pointers: Understanding and Managing Nonpoint Source Pollution in Your Community *(EPA)* ..$0.00
WWFSGN118 Concentrated Animal Feeding Operations (CAFOs) and Their Effect on Water Pollution *(EPA)*......................$0.40
WWFSGN145 Landscaping Septic Systems $0.75
WWFSGN157 Wastewater Treatment Programs Serving Small Communities *(EPA)* $0.70
WWFSGN167 Biosolids and Residuals Management Fact Sheet: Odor Control in Biosolids Management *(EPA)*..............$3.20
WWFSGN205 Why Do Septic Systems Malfunction? $0.40

EPA Biosolids Technology Fact Sheet. . .

WWFSGN168 Recessed-Plate Filter Press...................................$1.40
WWFSGN169 Land Application of Biosolids.............................$1.80
WWFSGN200 In-Vessel Composting of Biosolids $1.80
WWFSGN201 Centrifuge Thickening and Dewatering............$1.60
WWFSGN202 Alkaline Stabilization of Biosolids $1.80
WWFSGN203 Belt Filter Press..$1.40

EPA Decentralized Systems Technology Fact Sheet . . .

WWFSGN170 Aerobic Treatment $1.60
WWFSGN171 Septic Tank Leaching Chamber..........................$1.40
WWFSGN172 Small Diameter Gravity Sewers..........................$1.40
WWFSGN173 Mound Systems...$1.40
WWFSGN174 Septage TreatmentDisposal $1.40
WWFSGN175 Septic Tank Systems for Large Flow Applications $2.00
WWFSGN176 Recirculating Sand Filters.....................................$1.60
WWFSGN177 Types of Filters...$0.80
WWFSGN178 Septic Tank-Soil Absorption Systems $1.60
WWFSGN204 Evapotranspiration...$1.20
WWFSGN209 Low Pressure Pipe Systems.................................$1.40

Environmental Technology Initiative–A General Overview:

WWFSGN98 Ultraviolet Disinfection $0.20
WWFSGN99 Chlorine Disinfection...$0.20
WWFSGN100 Ozone Disinfection $0.20
WWFSGN101 Fine Bubble Aeration...$0.20
WWFSGN102 Trickling Filters—Achieving Nitrification............$0.20
WWFSGN103 Recirculating Sand Filters.....................................$0.20
WWFSGN104 Intermittent Sand Filters.......................................$0.20
WWFSGN105 Mound Systems...$0.20
WWFSGN106 Composting Toilet Systems.................................$0.20
WWFSGN107 Low-Pressure Pipe Systems.................................$0.20
WWFSGN109 Septage Management $0.20
WWFSGN110 Evapotranspiration Systems.................................$0.20
WWFSGN111 Water Efficiency $0.20
WWPKGN112 Complete Package of ETI Fact Sheets $2.60

Environmental Technology Initiative–A Technical Overview:

WWFSOM20 Ultraviolet Disinfection $0.40
WWFSOM21 Chlorine Disinfection...$0.40
WWFSOM22 Ozone Disinfection $0.40
WWFSOM23 Fine Bubble Aeration...$0.40
WWFSOM24 Trickling Filters—Achieving Nitrification............$0.40
WWFSOM25 Recirculating Sand Filters.....................................$0.40
WWFSOM26 Intermittent Sand Filters.......................................$0.40
WWFSOM27 Mound Systems...$0.40
WWFSOM28 Composting Toilet Systems.................................$0.40
WWFSOM29 Low Pressure Pipe Systems.................................$0.40
WWFSOM31 Septage Management $0.40
WWFSOM32 Evapotranspiration Systems.................................$0.40
WWFSOM33 Water Efficiency $0.40
WWPKOM34 Complete Package of ETI Fact Sheets $5.20

EPA NPDES Regulations Governing Management of:

WWFSGN119 Concentrated Animal Feeding Operations......$0.40
WWFSGN120 Concentrated Dairy Cattle Feeding Operations $0.40
WWFSGN121 Concentrated Horse Feeding Operations........$0.40
WWFSGN122 Concentrated Poultry Feeding Operations......$0.40
WWFSGN123 Concentrated Sheep Feeding Operations........$0.40
WWFSGN124 Concentrated Slaughter and Feeder Cattle Feeding Operations $0.40
WWFSGN125 Concentrated Swine Feeding Operations........$0.40

On-Site Wastewater Treatment Systems . . .

WWFSGN131 Conventional Septic Tank/Drain Field $1.00
WWFSGN151 (Spanish Version)........................$1.00
WWFSGN132 Subsurface Drip Distribution...............................$1.00
WWFSGN153 (Spanish Version)........................$1.00
WWFSGN133 Low-Pressure Dosing..$1.00
WWFSGN154 (Spanish Version)........................$1.00

WWFSGN134	Spray Distribution	$1.00
	WWFSGN152 (Spanish Version)	$1.00
WWFSGN146	Sand Filter	$1.00
WWFSGN147	Septic Tank/Soil Absorption Field	$1.00
WWFSGN148	Constructed Wetlands	$1.00
WWFSGN149	Spray Distribution System	$1.00
WWFSGN150	Evapotranspiration Bed	$1.00
WWFSGN160	Aerobic Treatment Unit	$1.00
WWFSGN163	Leaching Chambers	$1.00
	WWFSGN164 (Spanish Version)	$1.00
WWFSGN165	Gravelless Pipe	$1.00
	WWFSGN166 (Spanish Version)	$1.00
WWFSGN206	Tablet Chlorination	$1.00
	WWFSGN207 (Spanish Version)	$1.00
WWFSGN208	Trickling Filter	$1.00

EPA Wastewater Technology Fact Sheet . . .

WWFSGN179	Sequencing Batch Reactors	$1.80
WWFSGN180	Ozone Disinfection	$1.40
WWFSGN181	Wetlands: Subsurface Flow	$1.80
WWFSGN182	Free Water Surface Wetlands	$1.80
WWFSGN183	Intermittent Sand Filters	$1.40
WWFSGN184	Pipe Construction and Materials	$1.00
WWFSGN185	Sewers, Force Main	$1.80
WWFSGN186	In-Plant Pump Stations	$1.80
WWFSGN187	Fine Bubble Aeration	$1.40
WWFSGN188	Dechlorination	$1.40
WWFSGN189	Chlorine Disinfection	$1.40
WWFSGN190	High-Efficiency Toilets	$1.00
WWFSGN191	Chemical Precipitation	$1.60
WWFSGN192	Trickling Filter Nitrification	$1.80
WWFSGN193	Trickling Filters	$1.40
WWFSGN194	Package Plants	$2.40
WWFSGN195	Oxidation Ditches	$1.20
WWFSGN199	Ultraviolet Disinfection	$1.40

EPA Water Efficiency Technology Fact Sheet . . .

WWFSGN196	Composting Toilets	$1.40
WWFSGN197	Incinerating Toilets	$1.00
WWFSGN198	Oil Recirculating Toilets	$0.80

Finance and Management

WWBLFN01	Clean Water State Revolving Fund: How to Fund Nonpoint Source Estuary Enhancement Projects	$0.00
WWBRFN02	EPA's Clean Water Act Indian Set-Aside Grant Program	$0.00
FMBLFN03	A Water and Wastewater Manager's Guide for Staying Financially Healthy	$0.00
WWBLFN03	Answers to Frequently Asked Questions About the U.S. EPA Clean Water Indian Set-Aside Grant Program	$0.00
WWFSFN06	Clean Water State Revolving Fund Program	$0.00
WWFSFN07	Funding Decentralized Wastewater Systems Using the Clean Water State Revolving Fund	$0.00
FMBLFN13	A Utility Manager's Guide to Water and Wastewater Budgeting	$0.00
FMSWFN16	Determining Wastewater User Service Charge Rates: A Step-by-Step Manual with Software	$10.80
FMBLFN17	The Road To Financing: Assessing and Improving Your Community's Creditworthiness	$0.00
FMBKFN18	Financing Models for Environmental Protection: Helping Communities Meet Their Environmental Goals	$0.00
FMBLFN20	Clean Water State Revolving Fund: Financing America's Environmental Infrastructure—A Report of Progress	$0.00
FMBKFN22	Beyond SRF: A Workbook for Financing CCMP Implementation	$0.00
FMBLFN25	Clean Water State Revolving Fund Funding Framework	$0.00
FMFSFN27	Hardship Grants Program for Rural Communities	$0.00
FMBLFN28	State Match Options for the State Revolving Fund Program	$0.00
FMBLFN29	Federal Funding Sources for Small Community Wastewater Systems	$0.00
FMFSFN30	Cleaning Up Polluted Runoff with the Clean Water State Revolving Fund	$0.00
FMFSFN31	Protecting Wetlands with the Clean Water State Revolving Fund	$0.00
FMFSFN32	Funding Estuary Projects Using the Clean Water State Revolving Fund	$0.00
WWFSFN32	Rural Community Assistance Program (RCAP) Help for Small Community Wastewater Projects	$0.60
FMFSFN33	Funding of Small Community Needs Through the Clean Water State Revolving Fund	$0.80
FMBLFN34	USDA Loan and Grant Funding for Small Community Wastewater Projects	$1.60
FMFSFN35	Funding Water Conservation and Reuse with the Clean Water State Revolving Fund	$0.40
WWFSFN36	Baseline Information on Small Community Wastewater Needs and Financial Assistance	$0.40
WWBKFN37	Cost-Effective Analysis	$10.60
WWFSFN38	Wastewater Treatment Programs Available to Native Americans	$0.00
WWBLFN39	Reducing the Cost of Operating Municipal Wastewater Facilities	$0.00
FMBKGN01	It's Your Choice: A Guidebook for Local Officials on Small Community Wastewater Management Options	$7.50
FMBLGN14	Watershed Approach Framework	$0.00
FMBLGN15	Why Watersheds?	$1.60
FMBKGN16	Selecting Your Engineer . . . How to Find the Best Consultant for Small Town Water and Wastewater Projects	$18.00
FMBKPP03	Public-Private Partnerships for Environmental Facilities: A Self-Help Guide for Local Governments	$0.00
FMBLPP06	Developing Public-Private Partnerships: An Option for Wastewater Financing	$0.00
WWBKPP07	Guidance on the Privatization of Federally Funded Wastewater Treatment Works	$0.00

General Information

GNBLGN03	Watershed Protection Approach: An Overview	$0.00
GNBLGN11	Section 319 National Monitoring Program: An Overview	$0.00
GNBKGN12	Community-Based Environmental Protection: A Resource Book For Protecting Ecosystems and Communities (*Book on CD-ROM*)	$10.00
GNBLGN13	Environmental Indicators of Water Quality in the United States	$5.60
GNBKGN14	Watershed Protection: A Statewide Approach	$0.00
GNBKGN16	The Quality of Our Nation's Waters: Nutrients and Pesticides	$0.00
GNBLGN17	Animal Agriculture: Waste Management Practices	$2.55
WWBRGN19	Natural Systems for Wastewater Treatment in Cold Climates	$0.00
WWBLGN31	Inflow/Infiltration: A Guide for Decision Makers	$8.60
WWBKGN39	Septic Tank Siting to Minimize the Contamination of Ground Water by Microorganisms	$19.40
WWBLGN55	GAO Report: Water Pollution Information on the Use of Alternative Wastewater Treatment Systems	$2.60
WWBKGN58	Guide to Septage Treatment and Disposal	$0.00
WWBLGN59	Biosolids Recycling: Beneficial Technology for a Better Environment	$0.00
WWBKGN93	Response to Congress on Use of Decentralized Wastewater Treatment Systems	$18.20
WWBLGN94	Waste Water Justice? Its Complexion in Small Places	$0.00
WWBLGN95	Small Community Wastewater Systems	$2.40
WWBKGN96	Compendium of Tools for Watershed Assessment and TMDL Development	$0.00
WWBKGN97	1996 Clean Water Needs Survey: Report to Congress	$0.00
WWBRGN113	Composting Biosolids	$0.00
WWBRGN114	Land Application of Biosolids	$0.00
WWBRGN115	Sewage Sludge Incineration	$0.00

WWBRGN116	Sludge or Biosolids	$0.00
WWBKGN127	Clean Water Tribal Resource Directory For Wastewater Treatment Assistance	$0.00
WWBLGN144	Response to Congress On Privatization of Wastewater Facilities	$6.25
WWBLGN155	U.S. Census Data on Small Community Housing and W.astewater Disposal and Plumbing Practices	$1.60
WWBLGN156	1996 Clean Water Needs Survey: Small Community Wastewater Needs	$1.60
WWBKGN161	Animal Feeding Operations: The Role of Counties	$5.00

NODP Publications

DPBLGN01	Education, technology, and management system demonstrations in rural Vermont	$3.50
DPBLGN02	Demonstration of innovative onsite wastewater systems in the Green Hill Pond watershed of Rhode Island	$2.25
DPBLGN03	An innovative technology and management district demonstration in an impaired watershed in southern Pennsylvania	$1.95
DPBLGN04	A demonstration of innovative treatment and disposal technologies in environmentally sensitive karst terrain near Rock Bridge Memorial State Park Missouri	$1.95
DPBLGN05	Monongalia Management and Maintenance Partnership Project (3MP), Monongalia County, West Virginia	$1.95
DPBLGN06	Demonstration of innovative treatment and disposal systems in the former coal-mining town of Burnett, Washington	$2.65

The National Onsite Demonstration Program

DPFSGN07	Overview	$0.00
DPFSGN08	Phase I	$0.00
DPFSGN09	Phase II	$0.00
DPFSGN10	Phase III	$0.00
DPFSGN11	Projects Database	$0.00
DPPKGN12	Complete Package	$0.00
DPFSMG01	On-Site Wastewater Management	$0.80
DPFSMG02	On-Site Wastewater Management: Cost and Financing	$0.80
DPBRMG08	Managing Onsite Wastewater Treatment Systems Adds Value	$0.00

NSFC Publications

SFBKHD01	National Onsite Wastewater Treatment: A NSFC Summary of Onsite Systems in the United States, 1993	$0.00
SFCDHD02	A Summary of the Status of Onsite Wastewater Treatment Systems in the United States During 1998	$10.00
WWCDGN162	Wastewater Resources for Small Communities	$14.95

Pipeline

SFPLNL01	Combined Sewer Overflows	$0.40
SFPLNL02	Septic Systems: A Practical Alternative for Small Communities	$0.40
SFPLNL03	Maintaining Your Septic System: A Guide for Homeowners	$0.40
SFPLNL04	Home Aerobic Wastewater Treatment: An Alternative to Septic Systems	$0.40
SFPLNL05	Management Programs Can Help Small Communities	$0.40
SFPLNL06	Wastewater Treatment Protects Small Community Life, Health	$0.40
SFPLNL07	Alternative Sewers: A Good Option for Many Communities	$0.40
SFPLNL08	Choose the Right Consultant for Your Wastewater Project	$0.40
SFPLNL09	Lagoon Systems Can Provide Low-Cost Wastewater Treatment	$0.40
SFPLNL10	Sand Filters Provide Quality, Low-Maintenance Treatment	$0.40
SFPLNL11	Basic Wastewater Characteristics	$0.40
SFPLNL12	A Homeowner's Guide to Onsite System Regulations	$0.40
SFPLNL13	Inspections Equal Preventative Care for Onsite Systems	$0.40
SFPLNL14	Constructed Wetlands: A Natural Treatment Alternative	$0.40
SFPLNL15	Managing Biosolids in Small Communities	$0.40
SFPLNL16	Spray and Drip Irrigation for Wastewater Reuse, Disposal	$0.40
SFPLNL17	Infiltration and Inflow Can Be Costly for Communities	$0.40
SFPLNL18	Mounds: A Septic System Alternative	$0.40
SFPLNL19	Funding Sources Are Available for Wastewater Projects	$0.40
SFPLNL20	Evapotranspiration Systems	$0.40
SFPLNL21	Site Evaluations	$0.40
SFPLNL22	Alternative Toilets: Options for Conservation and Specific Site Conditions	$0.40
SFPLNL23	Decentralized Wastewater Treatment Systems	$0.40
SFPLNL24	Water Softener Use Raises Questions for System Owners	$0.40
SFPLNL25	Planning Is Essential for Successful Onsite System Management	$0.40
SFPLNL26	Gravelless and Chamber Systems: Alternative Drainfields Designs	$0.40
SFPLNL27	Paying for Onsite System Management	$0.40
SFPLNL28	Graywater: Safe Reuse and Recycling	$0.40
SFPLNL29	Soil Characteristics: Demystifying Dirt	$0.00
SFPLNL30	How to Keep Your Water 'Well'	$0.00
SFPLNL31	Alternative Dispersal Options	$0.00

Small Flows Quarterly

SFQUNL01	Winter 2000	$1.00
SFQUNL02	Spring 2000	$1.00
SFQUNL05	Winter 2001	$1.00
SFQUNL06	Spring 2001	$1.00
SFQUNL07	Summer 2001	$1.00
SFQUNL08	Fall 2001	$1.00
SFQUNL09	Winter 2002	$1.00
SFQUNL10	Spring 2002	$1.00
SFQUNL11	Summer 2002	$1.00
SFQUNL12	Fall 2002	$1.00*
SFQUNL13	Winter 2003	$0.00

Operation, Maintenance, and Management

WWBLMG09	Choices for Communities: Wastewater Management Options for Rural Areas	$1.00
WWBKMG10	Ohio Livestock Manure and Wastewater Management Guide	$2.60
WWBLMG12	Watershed Management: A Policy-Making Primer	$2.30
GNBKMG13	Environmental Planning for Communities: A Guide to the Environmental Visioning Process Utilizing a Geographic Information System (GIS)	$0.00
WWBKMG14	Combined Sewer Overflows: Guidance for Permit Writers	$0.00
WWBKMG15	Combined Sewer Overflows: Guidance for Long-Term Control Plan	$0.00
WWBLMG16	Combined Sewer Overflows: Screening and Ranking Guidance	$0.00
WWBLMG17	2002-2003 National Decentralized Water Resources Capacity Development Project: Training, Research and Development Plan	$0.00
WWBLOM05	Analysis of Performance Limiting Factors (PLFs) at Small Sewage Treatment Plants	$4.20
WWBLOM06	On-Site Operator Training Program: Success in Every Region!	$5.20
WWBKOM09	POTW Sludge Sampling and Analysis Guidance Document	$20.00

WWBKOM16 Detection, Control, and Correction of Hydrogen Sulfide Corrosion in Existing Wastewater Systems........$0.00

WWBKOM17 Chemical Aids Manual for Wastewater Treatment Facilities $38.60

WWBLOM35 Onsite Assistance Program: Helping Small Wastewater Treatment Plants Achieve Permit Compliance $0.00

WWBLOM37 Constructed Wetlands for On-Site Septic Treatment: A Guide to Selecting Aquatic Plants for Low-Maintenance Micro-Wetlands $0.95

WWFSOM38 Land Application of Animal Manure................................$1.30

WWFSOM39 Enforcement Alert: Clean Water Act Prohibits Sewage ‘Bypasses’..$0.00

GNBLOM40 Guide to Safety in Confined Spaces................................$0.00

WWBKOM41 A Manual for Managing Septic Systems $30.00

WWBKOM42 Biosolids Management Handbook for Small Publicly Owned Treatment Works (POTWs)..............................$52.20

WWBKOM43 Draft Framework for Watershed-Based Trading $0.00

WWCDOM44 OASIS Operator Assisted Sewer Information System (Shareware)..$0.00

WWFSOM45 On-site Wastewater Treatment Systems: Operation and Maintenance...$1.00

WWFSOM46 (Spanish Version).......................................$1.00

Public Education

GNBRPE02 Everyone Shares a Watershed...$0.20

GNBRPE04 Test the Waters! Careers in Water Quality $0.20

GNBRPE05 Adopt Your Watershed...$0.00

GNFSPE07 Quality Development and Stormwater Runoff..............$0.35

WWBLPE01 Is Your Proposed Wastewater Project Too Costly? Options for Small Communities.......................................$1.20

WWPSPE02 Onsite Wastewater Treatment for Small Communities and Rural Areas..$1.25

WWBLPE07 Benefits of Water and Wastewater Infrastructure..........$0.00

WWBRPE17 Your Septic System: A Reference Guide for Homeowners...$0.25▲

WWBRPE18 The Care and Feeding of Your Septic System............$0.20▲
WWBRPE57 (Spanish Version).....................................$0.20▲

WWBRPE20 So...Now You Own a Septic System............................$0.20▲
WWBRPE58 (Spanish Version).....................................$0.20▲

WWBRPE21 Groundwater Protection and Your Septic System....$0.20▲
WWBRPE59 (Spanish Version).....................................$0.20▲

WWBRPE26 Preventing Pollution Through Efficient Water Use........$0.00

WWPKPE28 Homeowner’s Septic Tank Information Package $2.25

WWBLPE31 Sanitary Sewer Overflows: What Are They, and How Do We Reduce Them?...$0.00

WWPSPE35 Indicator Organisms in Wastewater Treatment..............$3.80

WWBLPE37 Homeowner Onsite System Recordkeeping Folder $0.45

WWBLPE38 Wastewater Treatment: The Student’s Resource Guide...$1.95

WWBLPE44 Clean Water for Today: What is Wastewater Treatment?...$1.30

WWBLPE46 Living on Karst: A Refrence Guide for Landowners in Limestone Regions...$0.00

GNBRPE51 Polluted $0.00

GNPSPE52 National Estuary Program: Bringing Our Estuaries New Life $0.00

WWBRPE53 How Wastewater Treatment Works . . . The Basics......$0.00

WWBKPE54 State of the Chesapeake Bay: A Report to the Citizens of the Bay Region..$0.00

WWBRPE62 Fat-Free Sewers: How to Prevent Fats, Oils, and Greases from Damaging Your Home and the Environment..........$0.30

WWPSPE65 Wastewater Collection and Treatment Systems for Small Communities...$1.25

GNBKPE66 Home*A*Syst: An Environmental Risk-Assessment Guide for the Home...$10.00

Regulations

In addition to the regulat ory products listed below, the NSFC maintains other regulator y information in our online Regulations Database. To access this information, please log onto www.nesc.wvu.edu/nsfc/nsfc_regulations.htm . If you do not have Internet access, cont act the NSFC at the phone numbers below to request this additional inf ormation.

GNBLRG01 Introduction to Water Quality Standards........................$8.20

WWBKRG30 Control of Pathogens and Vector Attraction in Sewage Sludge $0.00

WWBLRG34 State Onsite Wastewater Regulatory Contacts List, December 2001 ....$0.00

WWBKRG35 Standards for the Use and Disposal of Sewage Sludge, 40 CFR, Part 503..$0.00

WWBKRG36 Domestic Septage Regulatory Guidance: A Guide to the EPA 503 Rule..$0.00

WWBKRG38 Plain English Guide to the EPA Part 503 Biosolids Rule...$0.00

WWBLRG42 NPDES and Sewage Sludge Program Authority: A Handbook for Federally Recognized Indian Tribes......$0.00

WWBKRG43 Land Application of Sewage Sludge: A Guide for Land Appliers on the Requirements of the Federal Standards for the Use or Disposal of Sewage Sludge, 40 CFR, Part 503..$0.00

WWBKRG44 Preparing Sewage Sludge for Land Application or Surface Disposal..$11.00

WWBLRG45 Surface Disposal of Sewage Sludge $9.40

WWBKRG51 NPDES Permit Writers’ Manual $0.00

WWBKRG64 Proceedings of the First National Onsite Wastewater State Regulators Conference...$9.20

WWFSRG65 Class V Injection Wells...$0.70

WWBKRG66* Guide to the Biosolids Risk Assessments for the EPA Part 503 Rule..$0.00

GNFSRG67 USEPA’s Program to Regulate the Placement of Waste Water and other Fluids Underground $0.00

Research

WWBLRE14 Methodology to Predict Nitrogen Loading from Conventional Gravity On-Site Wastewater Treatment Systems $5.00

WWBKRE16 Preliminary Risk Assessment for Viruses in Municipal Sewage Sludge Applied to Land $0.00

WWBLRE18 Rock-Plant Filter: An Alternative for Onsite Sewage Treatment $2.25

WWBLRE19 NPCA Septic Tank Project 1990–1995..........................$8.75

WWBLRE20 Field Performance of the Waterloo Biofilter with Different Wastewaters $6.25

WWBKRE21 Potential Effects of Water Softener Use on Septic Tank Soil Absorption On-Site Waste Water Systems................$12.20

WWBKRE23 Treatment Capability of Three Filters for Septic Tank Effluent..$27.25

WWBKRE24 Evaluation of the Performance of Five Aerated Package Treatment Systems $8.00

WWBKRE25 The Expanding Dairy Industry: Impact on Ground Water Quality and Quantity with Emphasis on Waste Management System Evaluation for Open Lot Dairies $11.70

WWBLRE28 Household Water Reduction and Design Flow Allowances for On-Site Wastewater Management and Supplement $4.00

WWBKRE29 Evaluation of Spray Irrigation as a Methodology for On-Site Wastewater Treatment and Disposal..............$21.00

WWBLRE30 Linear Regression for Nonpoint Source Pollution Analyses..$0.00

WWBLRE31 Variable Grade Sewers: Special Evaluation Project $4.25

WWBKRE32 Assessment of Single-Stage Trickling Filter Nitrification...$0.00

WWBLRE33 Sequencing Batch Reactors..$6.00

WWBKRE34 In-Vessel Composting of Municipal Wastewater Sludge $0.00

WWBLRE35 Report on the Use of Wetlands for Municipal Wastewater Treatment and Disposal $10.00

WWBKRE36 Subsurface Flow Constructed Wetlands for Wastewater Treatment $21.25

WWBKRE38 Literature Review for Septic Siting Study: A Means of Interpreting Past Research on Septic Systems $30.25

WWBKRE39 Septic Tank Nutrient Removal Project: Advanced Onsite Sewage Disposal System Demonstration $21.25

WWCDRE43 Septic Tank Nutrient Removal Project: Advanced Onsite Sewage Disposal System Demonstration *(Book on CD)* $10.00

GNBLRE40 Redoximorphic Features for Identifying Aquic Conditions....$6.50

WWBLRE42 Response to Congress on the AEES "Living Machine" Wastewater Treatment Technology....$10.50

Training Materials

NPDES Compliance Monitoring Inspec tor Training . . .

WWBKTR03 Sampling....$19.80

WWBKTR04 Biomonitoring $15.60

WWBKTR05 Overview $17.20

WWBKTR06 Legal Issues $23.20

WWBKTR07 Laboratory Analysis $27.80

Videotapes

FMVTMG01 Wastewater Management in Unsewered Areas....$10.00

WWVTGN10 Morrilton, Arkansas, Land Application of Wastewater....$10.00

WWVTGN117 Proper Treatment and Uses of Septage $15.00

WWVTGN135 Septic Systems: Making the Best Use of Nature $20.00

WWVTOM36 Sampling Wastewater at a Wastewater Treatment Facility $10.00

WWVTPE03 Sand Filter Technology....$10.00

WWVTPE04 Small Diameter Effluent Sewers....$10.00

WWVTPE05 Planning Wastewater Treatment for Small Communities $10.00

WWVTPE06 Upgrading Small Community Wastewater Treatment $10.00

WWVTPE16 Your Septic System: A Guide for Homeowners....$10.00

WWVTPE29 Artificial Marshland Treatment Systems....$10.00

WWVTPE33 Water Conservation: Managing Our Precious Liquid Asset $13.50

WWVTPE34 Keeping Our Shores/Protecting Minnesota Waters: Shoreland Best Management Practices....$25.00

WWVTPE42 Dollars Down the Drain: Caring for Your Septic Tank $10.00

WWVTPE43 Septic Systems Revealed: Guide to Operation, Care, and Maintenance $15.00

WWVTPE45 Maintaining Your Home Aeration Sewage Treatment System....$10.00

WWVTPE47 Small Community Wastewater Treatment: Management and Myths....$10.00

WWVTPE48 Intermittent Sand Filter: State of the Art Onsite Wastewater Treatment....$10.00

WWVTPE49 PSMA Protocol: Inspecting On-lot Wastewater Treatment Systems $25.00

WWVTPE50 Problem with Shallow Disposal Systems $0.00

WWPKPE55 Alternative Septic Systems....$13.00

WWVTPE60 Recirculating Filter On-Site Sewage Disposal System....$10.00

WWVTPE61 Conventional On-Site Sewage Disposal System: Your Septic System, What It Is and How To Take Care of It....$10.00

WWVTPE63 Next Generation of Sewage Treatment: "Flushing in the New Millennium" $30.00

WWVTPE64 Mound/Pressure Distribution On-Site Sewage Disposal System....$15.00

WWVTPE67 Down the Drain: Septic System Sense....$16.00

NETCSC Wastewater Products

Training Packages

TRTPEP01 Activated Sludge for Wastewater Operators/Training Package....$120.00

TRTPEP02 Aerobic Digestion for Wastewater Operators/Training Package....$110.00

TRTPEP03 Anaerobic Digestion for Wastewater Operators/Training Package....$110.00

TRTPCD06 Assessing Wastewater Options for Small Communities: for Local Decisionmakers/Training Package $102.70

Individual Components of TRTPCD06:

TRTGCD33 Assessing Wastewater Options for Small Communities: for Local Decisionmakers/ Trainer's Manual....$58.50

TRPMCD34 Assessing Wastewater Options for Small Communities: for Local Decision-makers/Participant's Guide....$59.80

TRSWCD35 Microsoft PowerPoint® Presentation (PC Format) $10.00

TRSWCD37 Microsoft PowerPoint® Presentation (Mac Format)..$10.00

TRTPEP05 Centrifuge Test for Wastewater Operators/Training Package $60.00

TRTPEP04 Concepts of Biological Treatment for Wastewater Operators/Training Package....$117.00

TRTPEP09 Depth of Blanket for Wastewater Operators/Training Package $90.00

TRTPEP11 Fecal Coliform-Membrane Filtration Procedure for Operators/Training Package $95.00

TRTPCD16 Industrial Pretreatment and Hazardous Material Recognition for Small Communities for Wastewater Operators/Training Package....$111.80

Individual Components of TRTPCD16:

TRTGCD17 Industrial Pretreatment and Hazardous Material Recognition for Small Communities for Wastewater Operators/Instructor's Guide $66.30

TRPMCD18 Industrial Pretreatment and Hazardous Material Recognition for Small Communities for Wastewater Operators/Participant's Manual $55.90

TRTPEP10 Lagoons: Facultative and Aerated for Wastewater Operators/Training Package $88.00

TRSWCD38 Onsite Sewage Treatment and Disposal System Interactive Training CD-ROM....$135.00

TRTPCD09 Onsite Wastewater System Operation and Maintenance/ Training Package $299.00

Individual Components of TRTPCD09:

TRTGCD10 Instructor's Guides....$55.90

TRRPCD12 Trainer's Resource Package $265.10

TRTPEP14 Settleometer for Wastewater Operators/Training Package $55.00

TRTPCD32 Troubleshooting and Optimizing Wastewater Treatment Systems/Training Package....$232.70

Individual Components of TRTPCD32:

TRTPCD27 Activated Sludge $98.80

TRTPCD28 Nutrient Removal $98.80

TRTPCD29 Attached Growth $98.80

TRTPCD30 Lagoon Processes....$94.90

TRTPCD31 Reference Text....$52.00

Training Aids

TRBKOM11 Activated Sludge: Evaluating and Controlling Your Process (Fourth Edition)....$16.95

TRVTOM01 Analysis of Biochemical Oxygen Demand/Video and Workbook....$45.50

TRBLFN06 Evaluating Municipal Wastewater User Charge Systems ..$9.90

TRVTOM05 Identification of Filaments in the Activated Sludge Process/Video $0.00

TRFSPE09 Landscaping Septic Systems $0.75

TRPKOM07 RTW Activated Sludge Troubleshooting Guide....$49.50

TRBKPE11 Septic System Owner's Guide $4.00

TRBLPE08 Taking Care of Your Septic System: Owner's Basics....$0.50

TRVTPE05 Total Suspended Solids Determination/ Video and Workbook....$29.80

TRPSOM08 Troubleshooting Guide for Lagoons/Poster....$3.05

TRPSOM09 Troubleshooting Guide for Rotating Biological Contactors/Poster....$2.15

TRPSOM15 Troubleshooting Guide for Trickling Filters/Poster....$2.60

TRFSPE10 Understanding Your Septic System....$0.75

Training-Related Information

TRBLOM03 Wastewater Certification for Wastewater Operators and Maintainers....$4.00

TRBKGN08 Wisconsin State Wastewater Center Study Guides....$42.80

Ordering Information

Phone:
(800) 624-8301 or
(304) 293-4191
Business hours are 8 a.m. to 5 p.m. Eastern Time

E-mail:
nsfc_orders@mail.nesc.wvu.edu

Fax:
(304) 293-3161

Mail:
National Small Flows Clearinghouse
West Virginia University
P.O. Box 6064
Morgantown, WV 26506-6064

Please indicate the product item number, title, cost, quantity, and total for each item ordered. Make sure you include your name, affiliation, address, and phone number with each order.

Free items are limited to one of each per order.

Shipping charges reflect the actual costs of shipping all orders. All orders from outside the U.S. (excluding Canada) must be prepaid.

All payments must be in U.S. dollars using VISA, MasterCard, Discover, check, or money order.

To place your order using VISA, MasterCard, or Discover, include your credit card number, expiration date, and signature on the order form.

Make checks payable to **WVU Research Corporation.**

Please allow two to four weeks for delivery.

CUT OR COPYFORM FOR ORDERING

Products Order Form

Item Number	Title	Cost	Qty.	Total

Subtotal ____________
Shipping ____________
Total Cost ____________

Name ____

Affiliation ____

Address ____

City ______________________ State _____ Zip Code ___________

Phone (___) ______________ Fax (___) ______________

E-mail Address ____

Please check form of payment:

☐ Check/Money Order ☐ MasterCard ☐ VISA ☐ Discover

Card Number ________________________________

Expiration Date ____________________

____
Signature *(Required for credit card orders.)*

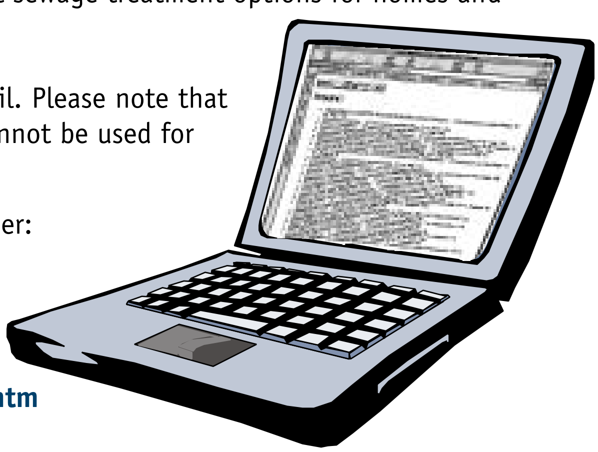
Join the NSFC News Listserv

If you would like to receive news about NSFC products or services, subscribe to our electronic mailing list. This notification service gives subscribers the opportunity to learn of NSFC activities and other information about sewage treatment options for homes and small community developments.

Information is sent to subscribers via e-mail. Please note that this listserv is for notification only, and cannot be used for posting messages.

To subscribe to the NSFC News Listserv, either:

- send an e-mail to **subnsfcnews@mail.nesc.wvu.edu** (no additional text is required) or
- log onto **www.nesc.wvu.edu/nsfc/nsfc_listserv.htm**



Lagoons Need Proper Operation and Maintenance

NSFC WRITER/EDITOR
Cathleen Falvey

Lagoon systems include one or more pond-like bodies of water or basins designed to receive, hold, and treat wastewater for a predetermined period of time. Lagoons are constructed and lined with material, such as clay or an artificial liner, that will prevent leaks to the groundwater below. One of the advantages of lagoons is they usually require fewer staff hours to operate and maintain than other systems; however, this doesn't mean they can be neglected. Routine inspections, testing, record keeping, and maintenance are required by local and state agencies, and are all necessary to ensure that lagoons continue to provide good treatment.

Routine Inspections

How often lagoons should be inspected depends on the type of lagoon, how well it functions, and local and state requirements.

Some lagoons need more frequent checking in the spring and summer, when grass and weeds grow quickly and when seasonal rental properties are occupied.

Systems with more than one lagoon operated in parallel or series may need operators to check and adjust flow levels or divert flows to and from certain lagoon cells to optimize performance. With aerated systems, mechanical components need to be checked and serviced as needed and according to manufacturer recommendations.

Most inspection visits include brief checks of the banks, dikes, grounds around the lagoon, inlet and outlet pipes, and the appearance, level, and odor (if any) of the water. Records should be kept of every visit and all observations, including information about the weather or other factors that may be influencing lagoon conditions. More extended inspections and formal sampling and testing are periodically necessary.

With regular inspections, testing, and record keeping, operators become familiar with the natural cycles and particular requirements of a system, as well as what factors tend to influence its performance.

Testing

Tests required for lagoons include those that measure the wastewater's temperature, pH, and the amount of dissolved oxygen, solids, nitrogen, and disease-causing organisms in the effluent.

Regulatory agencies use water quality measures as indicators of treatment system performance. Among the most important indicators are biochemical oxygen demand (BOD) and total suspended solids (TSS). BOD is important because it measures how much oxygen organisms in the wastewater would consume when discharged to receiving waters. TSS measures the amount of solid materials in the wastewater. If BOD or TSS levels in the effluent are too high, they can degrade the quality of receiving waters.

Together, the results of all these tests can provide a picture of the conditions inside the lagoon and show how well it was performing at the time the tests were taken. But because lagoon conditions change constantly, most tests must be performed several times, and sometimes at specific intervals or times of the day, to get an accurate overall view of the lagoon's health.

Operators can be trained to take samples and perform some or all of the tests themselves. It is usually more practical for part-time operators of small systems to send samples out to a lab to be tested.

Maintenance

Mowing grass and controlling weed growth in and around the lagoon is one of the easiest and most important tasks in lagoon maintenance. Long grass and weeds block wind and provide breeding areas for flies, mosquitoes, and other insects. Weeds also can trap trash, grease, and scum, which cause odors and attract insects. Weeds are used as food by burrowing animals that can cause damage to banks and dikes. In addition, dead weeds may contribute to increased BOD levels.

It is also important to control weeds that grow on the water surface, like duckweed and watermeal. These weeds take up valuable space that should be occupied by algae, and they can stop sunlight and wind from penetrating the wastewater.

Scum that collects on the water surface should be removed for the same reasons as duckweed, but also to control odors and insects and to prevent inlet and outlet clogging. Trash, leaves, and branches that blow around the lagoon should be picked up because they can also clog inlet and outlet pipes.

Finally, the depth of the sludge layer in lagoons should be checked at least once per year, usually from a boat using a long stick or hollow tube. In most lagoon systems, sludge eventually accumulates to a point it must be removed, although this may take years. Performance will suffer if too much sludge is allowed to accumulate.

Reprinted from Pipeline, *Spring 1997, vol. 8., no. 2. NSFC Item #SFPLNL09. Price $0.40 plus shipping.*

Celebrating 24 Years!

The National Small Flows Clearinghouse (NSFC) is celebrating twenty-four years of helping small communities, and we are asking industry leaders to participate in our celebration by contributing to our capital campaign.

Our idea of celebrating is to offer more and better services to our existing customers while aggressively increasing national and international awareness of major health and environmental issues resulting from wastewater mismanagement.

Your gifts to the NSFC will be used to accomplish the following:

Create a one-stop-shop for financial information
Individuals and small communities who are in need of financial support to address their wastewater infrastructure problems need a central location for obtaining information on available grants and low-interest loans as well as information on how to write proposals and compare financial options.

Get the wastewater industry moving!
We have made progress with our Regulators and Captains of Industry conferences, but there is much more to do! This industry is young and needs direction from its leaders. We want to continue our role of facilitating industry leaders and policy makers as they collaborate to accomplish industry advancements.

Reach the public
What good is knowledge and experience if it is not shared? The NSFC has an aggressive outreach crusade to target specific states and groups who need to know we are here for them. This is important to us because industry progression begins with education. Our goal is to increase awareness of wastewater-related health and environmental issues overall by 20 percent nationwide.

Celebrate with us as we set out to accomplish our goals!

!

I want to support the National Small Flows Clearinghouse at the recommended sponsorship level check marked below:

o **Tier I** ($10,000 and more) o **Tier III** ($5,000 to $7,499) o **Tier V** ($1,000 to $2,499)
o **Tier II** ($7,500 to $9,999) o **Tier IV** ($2,500 to $4,999) o **Tier VI** Gifts under $1,000

o Please have the NSFC campaign leader contact me to discuss gift opportunities.

1. Address

Name ______________________________
Company Name ______________________________
Address ______________________________
City ____________________ State / Province ____________________
Country ____________________ Zip Code ____________________
Phone ____________________ Fax ____________________
E-mail ____________________ Web site ____________________

2. Payment: o My check is enclosed.
Checks should be made payable in U.S. currency to: The West Virginia University Foundation, Inc.
One Waterfront Place
P.O. Box 1650, Morgantown, WV 26507-1650
The NSFC Account

o Please have the NSFC campaign leader contact me for special payment arrangements.

3. Signature of individual granting sponsorship ____________________ Date __________

Contact Information: Sherry Summers or Peter Casey **Phone numbers:** (800) 624-8301 or (304) 293-4191
E-mail: *ssummers@mail.nesc.wvu.edu* or *pcasey@mail.wvu.edu*
Or the completed form may be faxed to Sherry Summers at (304) 293-3161

America's
Information Source on Small Community and Onsite Sewage Systems

Looking for information about wastewater collection, treatment, and disposal?
The National Small Flows Clearinghouse (NSFC) can help.

Funded by the U.S. Environmental Protection Agency, the NSFC is a nonprofit organization that assists small communities (those with populations less than 10,000) with their wastewater-related needs. We offer a wide variety of resources about such topics as:

- septic systems and alternative onsite and community wastewater treatment technologies,
- regulations,
- operation and maintenance,
- design and monitoring,
- strategies for managing small wastewater systems, and
- public education.

The NSFC helps homeowners, local and state government officials, renters, bankers, citizens' groups, regulators, research scientists, educators, consultants, manufacturers, operators, contractors, and other professionals. We produce two quarterly publications, *Small Flows Quarterly* and *Pipeline*, which are free by request to U.S. residents. Our Web site hosts discussion groups on wastewater issues and provides information about conferences and events across the country.

In addition, the NSFC operates a toll-free technical assistance hotline available Monday through Friday from 8 a.m.– 5 p.m. Eastern Time. The NSFC provides outreach services through workshops, seminars, and conference participation. We have an inventory of more than 430 free and low-cost educational wastewater products. Contact us today for a free information packet!

National Small Flows Clearinghouse
West Virginia University Research Corporation
West Virginia University
P.O. Box 6064
Morgantown, WV 26506-6064

(800) 624-8301/(304) 293-4191
www.nsfc.wvu.edu

National Small Flows Clearinghouse
West Virginia University Research Corporation
West Virginia University
P.O. Box 6064
Morgantown, WV 26506-6064

CHANGE SERVICE REQUESTED

NONPROFIT
ORGANIZATION
U.S. POSTAGE PAID
PERMIT NO. 35
JOHNSON CITY, TN